

APPENDIX A

SEDIMENT SAMPLING AND ANALYSIS REPORT



City of Seattle

LOWER DUWAMISH WATERWAY

SLIP 4 EARLY ACTION AREA

Sediment Sampling and Analysis Report

Submitted to
U.S. Environmental Protection Agency, Region 10
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ACRONYMS AND ABBREVIATIONS

City	City of Seattle
CQAP	construction quality assurance plan
CSL	cleanup screening level
EIM	environmental information management
EPA	U.S. Environmental Protection Agency
MLLW	mean lower low water
PCB	polychlorinated biphenyl
SAP	sampling and analysis plan
SOP	standard operating procedure
SMS	sediment management standards
SQS	Washington State Sediment Quality Standards
SVOC	semivolatile organic compound
TOC	total organic carbon
WAC	Washington Administrative Code

1 INTRODUCTION

This sediment sampling and analysis report is a part of the removal action completion report for the removal action of contaminated marine sediments and adjacent bank areas at the Slip 4 Early Action Area of the Lower Duwamish Waterway Superfund Site located in Seattle, Washington (Figure 1-1). The removal action implemented U.S. Environmental Protection Agency's (EPA's) selected alternative as defined in EPA's Action Memorandum (USEPA 2006). The City of Seattle (City) conducted the Slip 4 sediment removal action. The construction quality assurance plan (CQAP) (Integral 2010a) outlined the overall construction project approach to quality assurance and the role of the sediment sampling activities in relation to other project elements.

Within the Slip 4 Early Action Area, polychlorinated biphenyls (PCBs) were the chemicals of concern in sediments. The removal boundary encompassed approximately 3.6 acres. The primary objective of the removal action was to reduce the concentrations of contaminants in post-cleanup surface sediments (biologically active zone [0–10 cm]) to below the Washington State Sediment Quality Standards (SQS) for PCBs and other chemicals. The removal alternative included removal of contaminated sediments at the head of the slip, construction of an engineered sediment cap over the entire Slip 4 removal area, and long-term monitoring of the capped area (USEPA 2006). The sediment removal action significantly reduced unacceptable risks to the aquatic environment resulting from potential exposure to contaminants in sediments in the slip. This cleanup also reduced potential human health risks associated with PCBs in sediment within the Lower Duwamish Waterway.

Surface sediments/soils and bank cap materials were sampled as part of the removal action for the following purposes:

1. Document the pre- and post-construction boundary area conditions
2. Document the post-excavation bank slope conditions
3. Confirm post-construction sediment quality throughout Slip 4 and along the adjacent side slope areas.

1.1 REPORT OBJECTIVES

This report documents the field activities associated with the collection of data needed to verify the completeness of the removal action in Slip 4 including the field activities associated with sediment sampling, resulting data, and associated quality assurance summary of the data.

1.2 REPORT ORGANIZATION

The remaining sections of this document describe sediment sampling and analysis activities as described in the CQAP (Integral 2010a). Section 2 provides a description of the field sampling activities. Section 3 discusses deviations from the sampling and analysis plan (SAP) (Integral 2010b). Section 4 provides details of field changes. Quality assurance/quality control results are described in Section 5. References are provided in Section 6.

Supporting information is provided in the following attachments:

- **Attachment A.** Sample Collection Forms
- **Attachment B.** Field Notes
- **Attachment C.** Photo Documentation
- **Attachment D.** Laboratory Reports
- **Attachment E.** Comparison of Post-excavation Bank Slope Samples to Historical Data
- **Attachment F.** Data Validation Reports.
- **Attachment G.** An analytical database of Slip 4 sample data provided in Ecology's environmental information management (EIM) format.

2 SEDIMENT SAMPLING

The following sampling programs were completed to support the Slip 4 removal action:

1. Pre-construction sediment sampling in the boundary area
2. Post-construction sediment sampling in the boundary area, including additional sampling following placement of additional material
3. Post-excavation bank slope sampling
4. Post-construction bank slope cap sampling
5. Post-construction waterway cap sampling.

Details of these sampling programs are described in this section. Sample locations and PCB data are shown on Figures 2-1 through 2-5. The types of samples required, the rationale, and analyses are listed in Table 2-1 of the SAP (Integral 2010b). The location coordinates for the intertidal bank samples and surface subtidal grab samples are provided in Table 2-1. Laboratory results are summarized in Tables 2-2 through 2-6, including comparison to SQS criteria.

The SQS concentration level for PCBs is 12 milligrams per kilogram organic carbon (mg/kg OC) when the total organic carbon (TOC) is between 0.5 and 4.0 percent. Similarly, the cleanup screening level (CSL) for PCBs is 65 mg/kg OC. When TOC is outside the normalization range, comparison is made to the lowest apparent effect threshold of 130 µg/kg based on dry weight, and the CSL reported in the Lower Duwamish Waterway feasibility study of 1,300 µg/kg based on dry weight.

Additional field observations, including sampling times, weather conditions, water conditions, and other anecdotal information were noted on sediment sample collection forms (Attachment A) and in field notes (Attachment B). Photos documenting sample collection are presented in Attachment C. The complete laboratory reports are provided in Attachment D.

2.1 PRE- AND POST-CONSTRUCTION BOUNDARY AREA SAMPLING

Sediment samples from the removal area boundary were collected before initiation of the removal action and after completion of in-water construction. On August 24, 2011, prior to in-water construction, surface sediments (0–10 cm horizon) were collected from eight stations in Slip 4 (Figure 2-1). These samples were analyzed for TOC, metals, PCBs, and semivolatile organic compounds (SVOCs) per the SAP. Pre-construction boundary area sediment data is presented in Table 2-2, with comparisons to Washington State Department of Ecology's Sediment Management Standards (SMS; WAC 173-204).

On February 1 and 2, 2012, after completion of in-water construction, surface (0–10 cm) sediment samples were collected near the same eight locations with the exception of Station BD-4, which had a 30-ft location variance. The samples were submitted for the same suite of analyses. These samples were submitted for fast (48-hour) turnaround of verbal results to provide data for field decision-making. Laboratory results for the post-construction samples indicated elevated concentrations of PCBs above the SQS and other organic compounds at all locations (Figure 2-2, Table 2-3).

Upon review of these data, the City and EPA agreed that corrective action was warranted. A 9-in. nominal lift of waterway cap material was placed over the boundary area on February 7, 2012. Follow-up sampling was conducted on February 14, 2012 near the locations sampled on February 1 and 2, 2012, with the exception of Station BD-4, which was sampled near its August 24, 2011 location. Samples were submitted for analysis of PCBs and TOC on a standard (30-day) turnaround time. All total PCB results for the final boundary area confirmation sample results were below SMS criteria (Figure 2-3, Table 2-4).

2.2 POST-EXCAVATION BANK SLOPE SAMPLING

Bank sediment/soil samples were collected on November 14 and 16, 2011 following excavation but before placement of the slope caps. Twelve of 14 surface sediment/soil (0–10 cm horizon) samples were collected from discrete bank slope locations in Slip 4 (Figure 2-4). The target locations were at approximately +4 and +12 ft mean lower low water (MLLW). The remaining two samples (i.e., Stations PE-3 and PE-6) were four-point composite samples of surface sediment/soil collected from the subsample locations indicated on Figure 2-4. All of the bank sediment/soil samples were submitted for TOC, metals, PCB, and SVOC analyses. Data are presented in Table 2-5. Standard turnaround times were used for these samples because no field decisions were to be made based on the results.

Laboratory results showed that some post-excavation bank slope samples contained elevated concentrations of PCBs (Table 2-5). At EPA's request, a comparison of the current sample data for Stations PE-2 and PE-4 to historical data was conducted to determine if the exposed material was similar to the previously sampled sediment or if it was indicative of upland bank material. The results of the comparative analysis, which is provided in Attachment E, suggest that these stations generally represent natural waterway sediment, not upland soil.

2.3 POST-CONSTRUCTION SLOPE CAP CONFIRMATION SAMPLING

Confirmation samples were collected on January 30, 2012 following placement of the slope caps. A three-point composite sample of slope cap material (0–10 cm horizon) was collected from six stations in Slip 4 (Figure 2-5). The composite slope cap samples were submitted for analysis of TOC, metals, PCBs, and SVOCs, and the data are presented in Table 2-6 (SC-X samples). These samples were submitted for fast (48-hour) turnaround of verbal results to provide data for field decision-making. All post-construction slope cap confirmation sample results were below SMS criteria (Table 2-6).

2.4 POST-CONSTRUCTION WATERWAY CAP CONFIRMATION SAMPLING

Confirmation samples were collected on January 30 and February 1, 2012 after the placement of the final lift of capping material in the slip to confirm that the sediment cap met the design criteria. Discrete samples of surface sediment (0–10 cm sediment horizon) were collected from each of eight stations (Figure 2-5). The waterway cap confirmation sediment samples were submitted for analysis of TOC, metals, PCBs, and SVOCs, and the data are presented in Table 2-6 (WC-X samples). These samples were submitted for fast (48-hour) turnaround of verbal results to provide data for field decision-making. All post-construction waterway cap confirmation sample results were below SMS criteria (Table 2-6).

3 SAMPLING PLAN DEVIATIONS

In general, the design for collection and documentation of sediment samples presented in the CQAP (Integral 2010a) and detailed in the SAP (Integral 2010b) and associated appendices and standard operating procedures (SOPs) were followed during sediment sampling activities. During the course of the project, however, several deviations from the plan occurred.

EPA requested modification of boundary area sample stations to collect new data from locations that had indicated exceedances of chemicals of concern during or prior to the site characterization. In response, three stations (BD-4, BD-7, and BD-8) were moved slightly to occupy former sample locations.

The collection of many intertidal and bank sediment samples was accomplished by hand-held implements (stainless-steel spoon). A description of this method was not originally included in the surface sediment sampling SOP provided in Attachment A of the SAP (Integral 2010b). At the request of the EPA, Integral revised the SOP to include language discussing sample collection by hand-held implements, removal of 0.5-in. or larger rocks, and the use of a stainless-steel ruler during sample collection. The revised SOP was approved by EPA and all samples were collected using hand-held implements followed the methods described in the revised SOP.

Other specific deviations are described in the remainder of this section.

3.1 GENERAL SEDIMENT SAMPLING DEVIATIONS

General deviations that applied to all sampling efforts included:

- The removal action SAP specified that decontamination of the stainless-steel spoon, bowl, or grab sampler include a rinse with methanol. On August 22, 2011, Integral notified EPA of a field change to the SAP to indicate that if equipment decontamination required removal of residual oils, hexane would be used instead of methanol.
- The SAP specified that sample coolers would be maintained at a temperature of 4°C ($\pm 2^\circ\text{C}$) (Integral 2010b). One cooler delivered to the laboratory on February 14, 2012 was relinquished at a temperature of 1.9°C. This minor deviation did not affect data usability.
- The SAP specified that sample coolers would be sealed with three chain-of-custody seals, *This End Up* and *Fragile* labels. This labeling was not done because all coolers were hand-delivered to the laboratory by the sample team.

- Subtidal surface sediment samples were collected with a stainless-steel power grab sampler as opposed to the 0.1-m² van Veen grab sampler specified in the SAP, with the exception of samples SL4-SG-PE2 and SL4-SG-PE4.

3.2 POST-EXCAVATION BANK SLOPE SAMPLING

- Post-excavation subtidal Station PE-11 was to be sampled using a stainless-steel 0.1-m² van Veen grab sampler. This location was exposed at the time sampling was being conducted and was therefore collected with a stainless-steel spoon.
- Post-excavation intertidal Stations PE-5, PE-7, PE-9 and PE-13 were submerged at the time of sampling and therefore changed to subtidal surface sediment (0–10 cm horizon) stations. Samples were collected with the power grab sampler.

3.3 PRE- AND POST-CONSTRUCTION BOUNDARY AREA SAMPLING

- Pre-construction intertidal Station BD-8 was to be sampled using stainless-steel spades and/or spoons during low tide. This location was submerged at the time sampling was being conducted and was therefore collected with the power grab sampler.
- For pre-construction boundary area samples, sample penetration depth for location BD-1 was measured via calibration on a stainless-steel spoon. A plastic ruler was used in lieu of a stainless steel ruler to measure sample penetration depths for BD-2 thru BD-8. Care was taken to ensure that sediments in contact with the ruler were not part of the collected sample.
- Post-construction intertidal Stations BD-4 and BD-8 were to be collected using stainless-steel spades and/or spoons during low tide. These locations were submerged during the February 1 and 2 sampling event and were therefore sampled with the power grab sampler. During the follow-up post-construction sampling event on February 14, 2012, only Station BD-8 was submerged and thus sampled with the power grab sampler. The sample at Station BD-4 was collected with a stainless-steel spoon during low tide.
- Minor variations in the actual sample locations occurred throughout the project due to factors such as wind, currents, and occasional traffic within the slip. All of the post-construction boundary area samples were collected within 20 ft of the pre-construction sample locations except for Station BD-4 which was approximately 30 ft northwest of the pre-construction sample location. All of the follow-up post-construction boundary area samples were collected within 20 ft of the initial post-construction sample locations. The data collected for pre- and

post-construction sampling are believed to be comparable for each sample location with the possible exception of Station BD-4, due to its 30 ft location variance.

- During the follow-up post-construction sampling event on February 14, 2012, Samples BD-2, BD-6, and BD-8 were collected after several rejected grabs due to limited (estimated to be less than 10 percent) quantities of fine-grained material. To collect samples at these locations, the full contents of the power grab (that had penetrated 10 cm) were transferred to a bowl and the material greater than 0.5 in. was removed prior to placing the sample in jars. Photos of the grab contents for these samples are provided in Attachment C, Photos 375, 379, and 380.

3.4 POST-CONSTRUCTION SLOPE CAP CONFIRMATION SAMPLING

- Slope cap confirmation subsample locations planned for +2 ft MLLW were modified to +4ft MLLW to allow for intertidal sampling methods to be used, as the +2ft MLLW locations were nearly all submerged during the sampling event.
- Due to a lack of fines at the +4 and +8ft MLLW locations, subsamples of slope cap confirmation Station SC-5 were collected at +5 and +9ft MLLW locations.

3.5 POST-CONSTRUCTION WATERWAY CAP CONFIRMATION SAMPLING

- Waterway cap confirmation Stations WC-1, WC-2, WC-4, WC-6, and WC-8 were changed to subtidal surface sediment (0–10 cm horizon) stations and samples were collected with the power grab sampler. Stations WC-3, WC-5, and WC-7 were collected as subtidal stations as planned.
- Many waterway cap samples could not be collected at the target locations due to insufficient amounts of finer-grained sediment (material less than 0.5 in. in diameter). Rejected grabs contained either large rock (cap armor) or clean fine to coarse gravel (Attachment C, photo 333 and photo 334). In these situations, multiple grabs were attempted around the target sample location. When an acceptable grab could not be collected, the distance away from the target sample location was increased until an acceptable grab was collected. Acceptable grab samples generally had to have greater than 5 percent of the material volume less than 0.5 in. in diameter. The number of grabs rejected at a particular sample station was recorded in the field notes, but geographic positioning system coordinates were not collected for every rejected grab location. Stations WC-2,

WC-5, WC-6, WC-7, and WC-8 were sampled at locations greater than 20 ft from the target locations.

4 DATA MANAGEMENT AND REPORTING

The management and reporting of field and laboratory data generally followed the procedures outlined in the CQAP (Integral 2010a) and SAP (Integral 2010b). Changes or additions to those procedures are discussed below.

4.1 FIELD QUALITY CONTROL SAMPLES

Field quality control samples were used to assess sample variability and evaluate potential sources of contamination. Field quality control samples included field split samples and equipment rinsate blanks. Detailed information on quality assurance/quality control procedures, limits, and reporting are described in detail in the quality assurance project plan (Appendix B to the CQAP). The field quality control samples that were collected are listed in Tables 2-2 through 2-6. No corrective actions were required to meet the project's data quality objectives.

4.2 DATA QUALITY REVIEW

All laboratory results underwent data validation by an independent validator. Laboratory provided data packages for each sample delivery group or analysis are provided in Attachment D. Data validation packages for each sample delivery group or analysis are provided in Attachment F.

Full data validation reviews were completed for each of the seven data packages received from the laboratory. The data were generally acceptable. A total of three results for benzyl alcohol were rejected due to low to no recovery in the matrix spike/matrix spike duplicate analyses. Rejected data are not to be used for any purpose. Select data were qualified as estimated or nondetect based on matrix interferences or method blank contamination. Qualified data points may have a larger associated bias or may be less precise than unqualified data, but are usable for the intended purpose.

5 REFERENCES

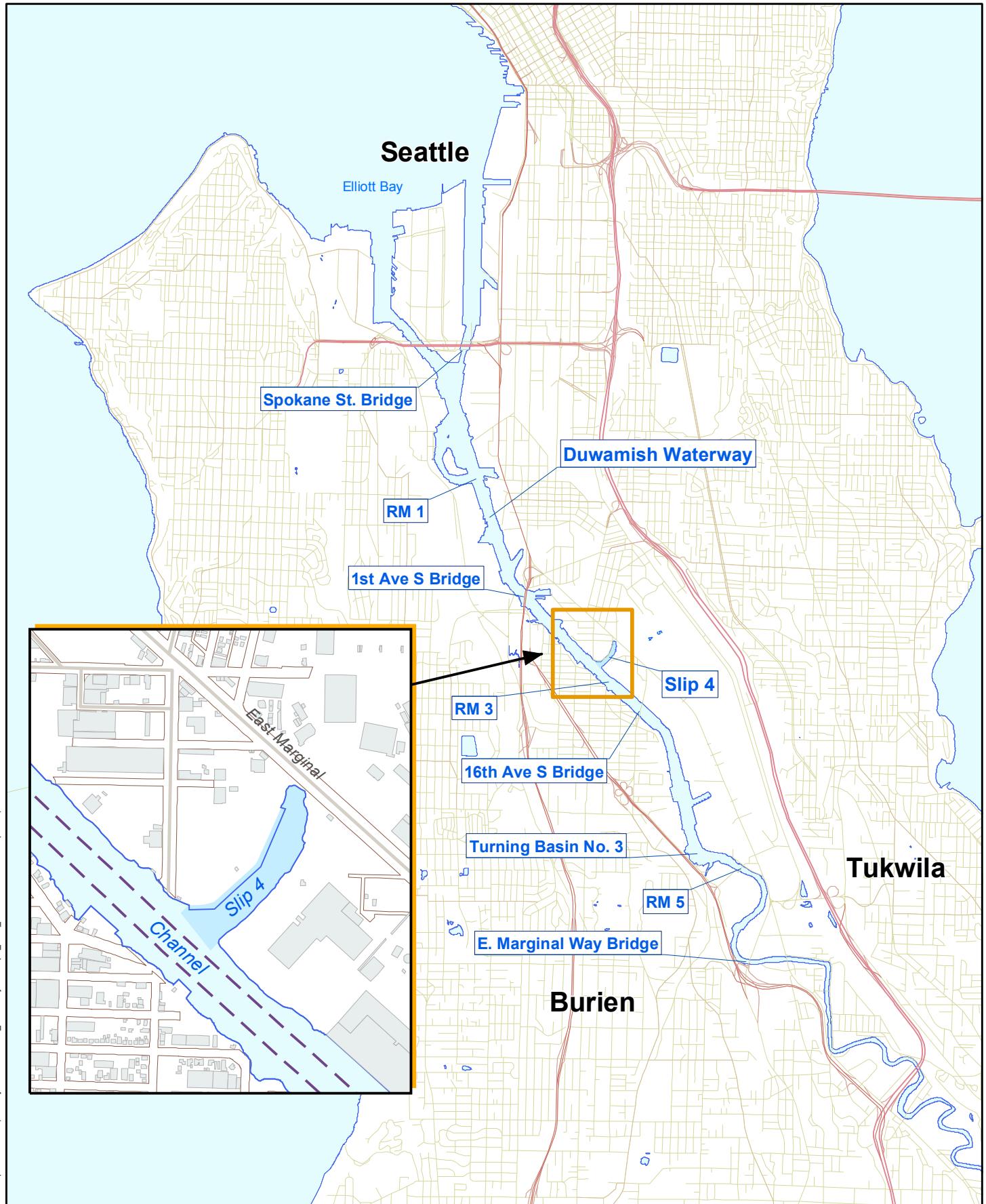
Integral. 2010a. Lower Duwamish Waterway Slip 4 Early Action Area: 100% Design Submittal, Construction Quality Assurance Plan. Prepared for City of Seattle and King County. Integral Consulting Inc., Seattle, WA.

Integral. 2010b. Lower Duwamish Waterway Slip 4 Early Action Area: 100% Design Submittal, Removal Action Sampling and Analysis Plan. Prepared for City of Seattle and King County. Integral Consulting Inc., Seattle, WA.

USEPA. 2006. Action memorandum for non-time critical removal action at the Slip 4 Early Action Area of the Lower Duwamish Waterway Superfund Site, Seattle, Washington, dated May 3, 2006. U.S. Environmental Protection Agency, Region 10, Seattle, WA.

USEPA. 2011. Clean Water Act §401 Water Quality Certification, Removal Action of Contaminated Marine Sediments and Bank Areas at Slip 4 Early Action Area, Lower Duwamish Waterway Superfund Site, Seattle, Washington, dated May 23, 2011. U.S. Environmental Protection Agency, Region 10, Seattle, WA.

FIGURES



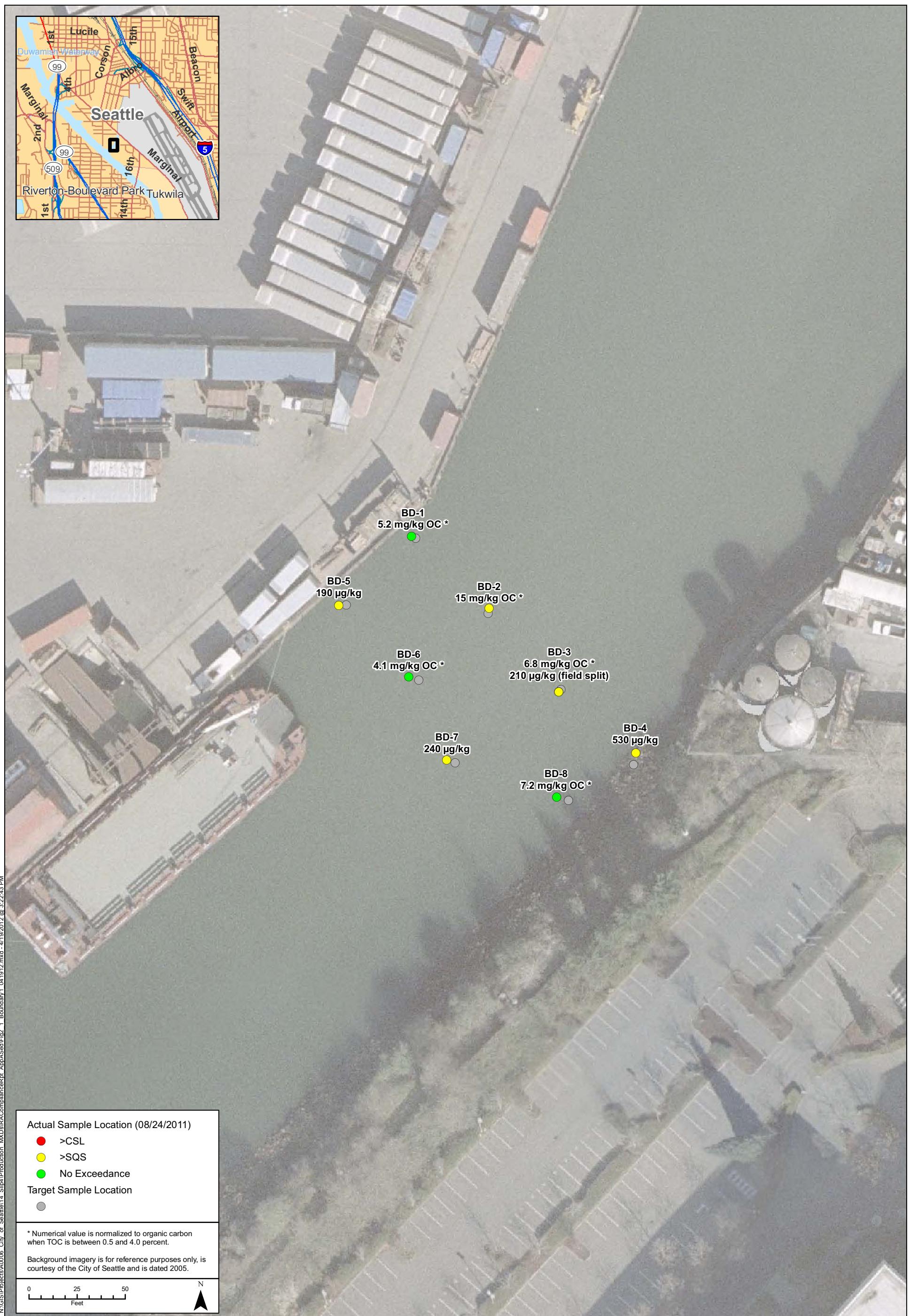


Figure 2-1.
PCB Concentrations in Surface Sediments Outside
the Slip 4 Removal Boundary Prior to Construction
Slip 4 Removal Action

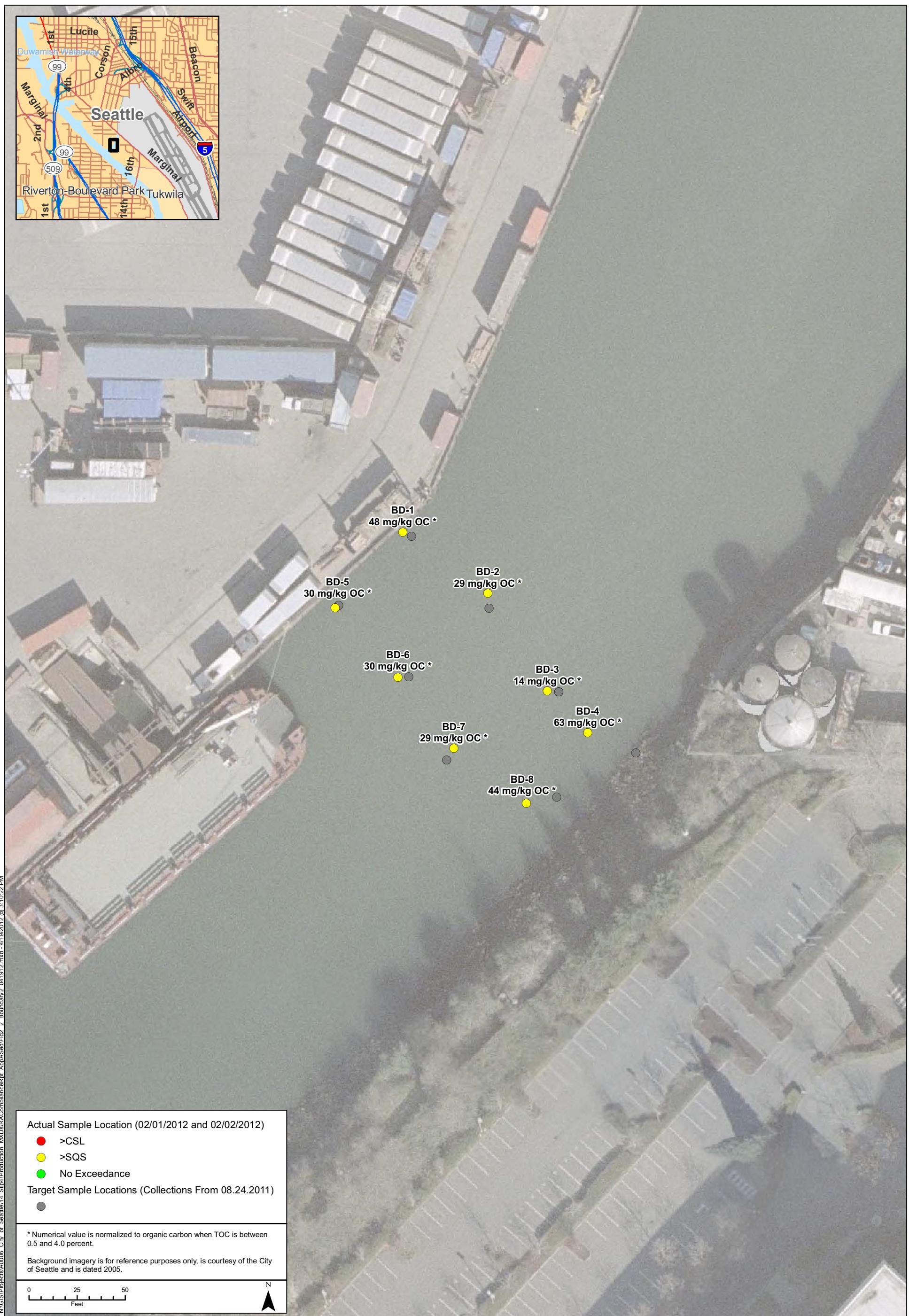
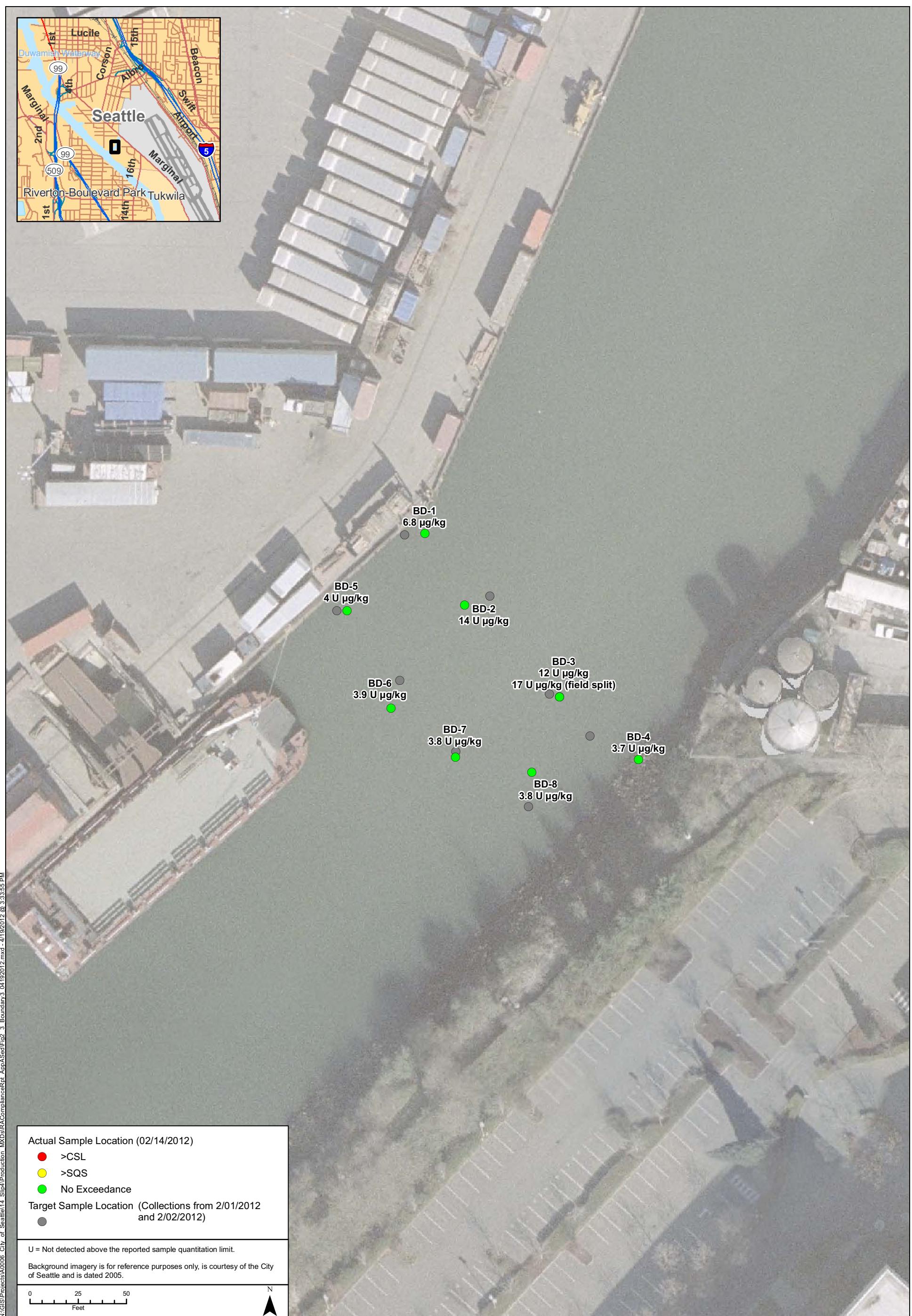


Figure 2-2.
PCB Concentrations in Surface Sediments Outside of
Slip 4 Removal Boundary Following Construction
Slip 4 Removal Action



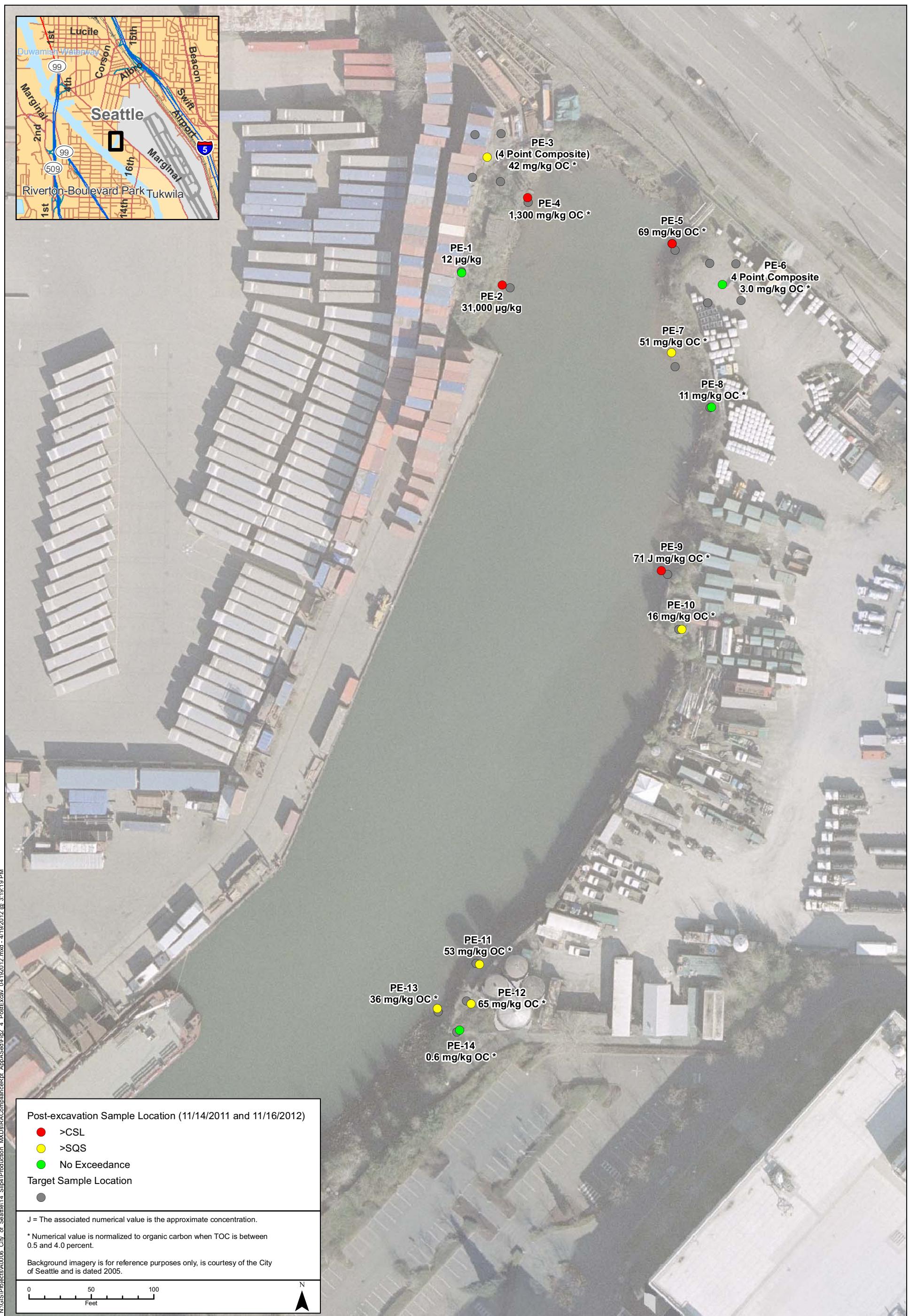


Figure 2-4.
PCB Concentrations in Post Dredge/Excavation
Slope Samples Prior to Capping
Slip 4 Removal Action



Figure 2-5.
PCB Concentrations in Cap Material
Slip 4 Removal Action

TABLES

Table 2-1. Station Coordinates

Station ID	Target Coordinates		Actual Coordinates	
	Northing	Easting	Northing	Easting
Boundary Area Documentation Stations^a				
BD-1	198904.61	1273232.52	198905.40	1273230.36
BD-2	198865.39	1273270.23	198868.14	1273270.66
BD-3	198826.17	1273307.95	198824.75	1273306.88
BD-4	198786.95	1273345.67	198793.15	1273346.79
BD-5	198869.95	1273196.48	198869.65	1273192.61
BD-6	198830.73	1273234.20	198832.46	1273228.95
BD-7	198788.00	1273253.00	198789.40	1273248.63
BD-8	198768.57	1273311.92	198770.05	1273305.82
Post-Excavation Bank Slope Documentation Stations				
PE-1	199401.16	1273383.76	199400.12	1273384.13
PE-2	199388.05	1273422.74	199390.12	1273416.54
PE-3a	199510.45	1273394.59	199510.66	1273388.39
PE-3b	199511.32	1273415.73	199510.36	1273417.28
PE-3c	199476.28	1273392.80	199470.75	1273416.81
PE-3d	199472.83	1273415.05	199474.57	1273395.46
PE-3	**	**	199492.56 ^e	1273404.63 ^e
PE-4	199456.40	1273437.32	199460.40	1273436.75
PE-5	199418.07	1273554.94	199423.43	1273552.44
PE-6a	199407.30	1273603.36	199405.34	1273580.59
PE-6b	199407.65	1273582.48	199406.21	1273602.94
PE-6c	199376.19	1273580.87	199375.58	1273605.16
PE-6d	199378.01	1273607.47	199376.19 ^d	1273580.87 ^d
PE-6	**	**	199390.63 ^e	1273592.50 ^e
PE-7	199324.94	1273554.95	199336.31	1273552.06
PE-8	199292.22	1273582.80	199292.66	1273583.82
PE-9	199158.84	1273548.71	199162.06	1273543.67
PE-10	199114.99	1273557.63	199115.20	1273560.18
PE-11	198847.98	1273395.72	198847.08	1273398.43
PE-12	198817.97	1273387.93	198815.39	1273391.69
PE-13	198809.01	1273365.27	198811.72	1273364.59
PE-14	198792.89	1273380.27	198794.62	1273382.43
Slope Cap Confirmation Stations				
SC-1-4	199391.46	1273401.02	199385.77	1273421.43
SC-1-8	199389.26	1273408.22	199390.53	1273408.82
SC-1-12	199392.79	1273396.70	199395.58	1273397.44
SC-1	**	**	199390.63 ^e	1273409.23 ^e
SC-2-4	199464.46	1273420.41	199437.24	1273443.05
SC-2-8	199442.18	1273424.87	199444.40	1273426.03
SC-2-12	199445.83	1273412.94	199449.10	1273411.69
SC-2	**	**	199443.58 ^e	1273426.92 ^e
SC-3-4	199413.54	1273566.20	199380.61	1273544.05
SC-3-8	199380.02	1273554.97	199378.60	1273555.46
SC-3-12	199378.81	1273566.91	199381.17	1273565.44
SC-3	**	**	199380.13 ^e	1273554.99 ^e
SC-4-4	199290.77	1273580.39	199288.08	1273564.50
SC-4-8	199288.94	1273574.33	199290.10 ^d	1273574.32 ^d
SC-4-12	199292.03	1273584.57	199292.79	1273585.85
SC-4	**	**	199289.94 ^e	1273574.89 ^e
SC-5-5	199145.76	1273547.47	199144.03	1273539.67

Table 2-1. Station Coordinates

Station ID	Target Coordinates		Actual Coordinates	
	Northing	Easting	Northing	Easting
SC-5-9	199145.71	1273552.15	199152.76	1273556.02
SC-5-12	199145.25	1273560.86	199145.86	1273561.82
SC-5	**	**	199147.55 ^e	1273552.50 ^e
SC-6-4	198853.95	1273403.40	198861.16	1273390.59
SC-6-8	198856.05	1273400.56	198858.25	1273403.83
SC-6-12	198848.99	1273410.13	198849.03	1273410.77
SC-6	**	**	198856.15 ^e	1273401.73 ^e
Waterway Cap Confirmation Stations				
WC-1	199421.60	1273468.82	199414.43	1273474.09
WC-2	199397.17	1273522.08	199399.42	1273499.06
WC-3	199250.46	1273409.34	199251.02	1273403.73
WC-4	199249.89	1273520.55	199247.87	1273513.70
WC-5	199120.27	1273356.30	199120.96	1273327.97
WC-6	199070.38	1273488.14	199095.26	1273398.35
WC-7	198934.48	1273280.20	199019.44	1273332.04
WC-8	198868.97	1273346.65	199012.05	1273404.64
Boundary Area Documentation Stations^b				
BD-1	198905.40	1273230.36	198907.79	1273225.87
BD-2	198868.14	1273270.66	198875.87	1273270.02
BD-3	198824.75	1273306.88	198825.23	1273300.96
BD-4	198793.15	1273346.79	198803.67	1273321.79
BD-5	198869.65	1273192.61	198868.45	1273190.72
BD-6	198832.46	1273228.95	198832.38	1273223.37
BD-7	198789.40	1273248.63	198795.54	1273252.43
BD-8	198770.05	1273305.82	198767.01	1273290.06
Boundary Area Documentation Stations^c				
BD-1	198907.79	1273225.87	198908.39	1273236.39
BD-2	198875.87	1273270.02	198871.43	1273256.97
BD-3	198825.23	1273300.96	198823.90	1273306.14
BD-4	198803.67	1273321.79	198791.32	1273347.00
BD-5	198868.45	1273190.72	198868.36	1273196.09
BD-6	198832.38	1273223.37	198817.98	1273218.88
BD-7	198795.54	1273252.43	198792.66	1273252.33
BD-8	198767.01	1273290.06	198784.78	1273291.73

Notes: Horizontal Datum: Washington State Plane Coordinate System, North Zone
(NAD-83/91), U.S. Feet

^a Pre-Construction Boundary Area Documentation Stations

^b Post-Construction Boundary Area Documentation Stations - target coordinates based on Pre-Construction Actuals

^c Post-Placement Boundary Area Documentation Stations - target coordinates based on Post-Construction Actuals

^d Station location is estimated based on visual observations as no location was recorded with the GPS

^e Station location is estimated based on calculated centroid for composite samples

Table 2-2. Validated Analytical Results for Slip 4 Pre-Construction Boundary Area Samples

		Sample ID	BD-1	BD-2	BD-3	BD-3 (field split)	BD-4	BD-5	BD-6	BD-7	BD-8
	Chemical Name	Lab ID	SD0001	SD0002	SD0003	SD0004	SD0005	SD0006	SD0007	SD0008	SD0009
	Method	SQS	CSL								
PCB Aroclors											
Aroclor 1016	SW8082		3.8 U µg/kg	3.9 U µg/kg	3.9 U µg/kg	3.8 U µg/kg	19 U µg/kg	3.8 U µg/kg	3.9 U µg/kg	3.8 U µg/kg	3.8 U µg/kg
Aroclor 1221	SW8082		3.8 U µg/kg	3.9 U µg/kg	3.9 U µg/kg	3.8 U µg/kg	19 U µg/kg	3.8 U µg/kg	3.9 U µg/kg	3.8 U µg/kg	3.8 U µg/kg
Aroclor 1232	SW8082		3.8 U µg/kg	3.9 U µg/kg	3.9 U µg/kg	3.8 U µg/kg	19 U µg/kg	3.8 U µg/kg	3.9 U µg/kg	3.8 U µg/kg	3.8 U µg/kg
Aroclor 1242	SW8082		3.8 U µg/kg	3.9 U µg/kg	3.9 U µg/kg	3.8 U µg/kg	19 U µg/kg	3.8 U µg/kg	3.9 U µg/kg	3.8 U µg/kg	3.8 U µg/kg
Aroclor 1248	SW8082		54 µg/kg	100 µg/kg	62 µg/kg	58 µg/kg	190 U µg/kg	54 µg/kg	42 µg/kg	64 µg/kg	78 µg/kg
Aroclor 1254	SW8082		82 µg/kg	150 µg/kg	97 µg/kg	91 µg/kg	310 µg/kg	80 µg/kg	64 µg/kg	100 µg/kg	130 µg/kg
Aroclor 1260	SW8082		61 µg/kg	97 µg/kg	70 µg/kg	64 µg/kg	220 µg/kg	59 µg/kg	41 µg/kg	80 µg/kg	76 µg/kg
Total Aroclors	Calculated	130	1300 ^a	200 µg/kg	350 µg/kg	230 µg/kg	210 µg/kg	530 µg/kg	190 µg/kg	150 µg/kg	240 µg/kg
Total Aroclors OC	Calculated	12	65	5.2 mg/kg-oc	15 mg/kg-oc	6.8 mg/kg-oc	-- mg/kg-oc	-- mg/kg-oc	-- mg/kg-oc	4.1 mg/kg-oc	-- mg/kg-oc
Conventionals											
Total organic carbon	Plumb1981		3.88 percent	2.36 percent	3.37 percent	5.1 percent	6.51 percent	4.2 percent	3.67 percent	5.18 percent	3.87 percent
Total solids	E160.3		30.3 percent	40.8 percent	41.4 percent	41.4 percent	41.4 percent	35.5 percent	39.3 percent	41.9 percent	44.1 percent
Metals											
Arsenic	SW6010B	57	93	20 U mg/kg	20 mg/kg	20 mg/kg	20 mg/kg	30 mg/kg	20 mg/kg	20 mg/kg	10 mg/kg
Cadmium	SW6010B	5.1	6.7	0.7 mg/kg	0.8 mg/kg	0.7 mg/kg	0.7 mg/kg	0.8 mg/kg	0.7 mg/kg	0.8 mg/kg	0.7 mg/kg
Chromium	SW6010B	260	270	35 mg/kg	37 mg/kg	35 mg/kg	35 mg/kg	39 mg/kg	36 mg/kg	37 mg/kg	35 mg/kg
Copper	SW6010B	390	390	62.6 mg/kg	68.8 mg/kg	65.3 mg/kg	64.7 mg/kg	78.3 mg/kg	68.1 mg/kg	64.8 mg/kg	66.4 mg/kg
Lead	SW6010B	450	530	22 mg/kg	27 mg/kg	25 mg/kg	25 mg/kg	47 mg/kg	26 mg/kg	25 mg/kg	25 mg/kg
Mercury	SW7471	0.41	0.59	0.16 J mg/kg	0.17 J mg/kg	0.31 J mg/kg	0.16 J mg/kg	0.13 J mg/kg	0.17 J mg/kg	0.17 J mg/kg	0.16 J mg/kg
Silver	SW6010B	6.1	6.1	0.9 U mg/kg	0.7 U mg/kg	0.7 U mg/kg	0.7 U mg/kg	0.7 U mg/kg	0.7 U mg/kg	0.7 U mg/kg	0.6 U mg/kg
Zinc	SW6010B	410	960	126 J mg/kg	150 J mg/kg	128 J mg/kg	135 J mg/kg	215 J mg/kg	131 J mg/kg	132 J mg/kg	128 J mg/kg
SVOCs											
1,2,4-Trichlorobenzene	SW8270D	0.81 mg/kg-oc / 31 µg/kg	1.8 mg/kg-oc / 51 µg/kg	0.49 U mg/kg-oc	0.85 U mg/kg-oc	0.59 U mg/kg-oc	19 U µg/kg	19 U µg/kg	0.52 U mg/kg-oc	19 U µg/kg	0.52 U mg/kg-oc
1,2-Dichlorobenzene	SW8270D	2.3 mg/kg-oc / 35 µg/kg	2.3 mg/kg-oc / 50 µg/kg	0.49 U mg/kg-oc	0.85 U mg/kg-oc	0.59 U mg/kg-oc	19 U µg/kg	19 U µg/kg	0.52 U mg/kg-oc	19 U µg/kg	0.52 U mg/kg-oc
1,3-Dichlorobenzene	SW8270D	170	170	19 U µg/kg	20 U µg/kg	19 U µg/kg	19 U µg/kg	19 U µg/kg	19 U µg/kg	19 U µg/kg	20 U µg/kg
1,4-Dichlorobenzene	SW8270D	3.1 mg/kg-oc / 110 µg/kg	9 mg/kg-oc / 110 µg/kg	0.49 U mg/kg-oc	0.85 U mg/kg-oc	0.59 U mg/kg-oc	19 U µg/kg	19 U µg/kg	0.52 U mg/kg-oc	19 U µg/kg	0.52 U mg/kg-oc
1-Methylnaphthalene	SW8270D	NA	NA	19 U µg/kg	20 U µg/kg	13 J µg/kg	19 U µg/kg	19 U µg/kg	19 U µg/kg	19 U µg/kg	20 U µg/kg
2,4-Dimethylphenol	SW8270D	29	29	39 U µg/kg	39 U µg/kg	39 U µg/kg	38 U µg/kg	38 U µg/kg	38 U µg/kg	39 U µg/kg	38 U µg/kg
2-Methylnaphthalene	SW8270D	38 mg/kg-oc / 670 µg/kg	64 mg/kg-oc / 670 µg/kg	0.46 J mg/kg-oc	0.85 U mg/kg-oc	0.45 J mg/kg-oc	19 U µg/kg	19 U µg/kg	0.52 U mg/kg-oc	12 J µg/kg	0.31 J mg/kg-oc
2-Methylphenol	SW8270D	63	63	19 U µg/kg	20 U µg/kg	20 U µg/kg	19 U µg/kg	19 U µg/kg	19 U µg/kg	19 U µg/kg	20 U µg/kg
4-Methylphenol	SW8270D	670	670	39 U µg/kg	39 U µg/kg	39 U µg/kg	38 U µg/kg	35 J µg/kg	19 J µg/kg	39 U µg/kg	23 J µg/kg
Acenaphthene	SW8270D	16 mg/kg-oc / 500 µg/kg	57 mg/kg-oc / 500 µg/kg	0.49 U mg/kg-oc	0.85 U mg/kg-oc	0.59 U mg/kg-oc	19 U µg/kg	19 U µg/kg	0.52 U mg/kg-oc	13 J µg/kg	0.52 U mg/kg-oc
Acenaphthylene	SW8270D	66 mg/kg-oc / 1300 µg/kg	66 mg/kg-oc / 1300 µg/kg	0.49 U mg/kg-oc	0.85 U mg/kg-oc	0.59 U mg/kg-oc	19 U µg/kg	19 U µg/kg	0.52 U mg/kg-oc	19 U µg/kg	0.52 U mg/kg-oc
Anthracene	SW8270D	220 mg/kg-oc / 960 µg/kg	1200 mg/kg-oc / 960 µg/kg	0.41 J mg/kg-oc	0.59 J mg/kg-oc	0.39 J mg/kg-oc	12 J µg/kg	34 µg/kg	33 µg/kg	0.52 U mg/kg-oc	27 µg/kg
Benz(a)anthracene	SW8270D	110 mg/kg-oc / 1300 µg/kg	270 mg/kg-oc / 1600 µg/kg	1.2 mg/kg-oc	2.1 mg/kg-oc	0.80 mg/kg-oc	34 µg/kg	90 µg/kg	180 µg/kg	0.79 mg/kg-oc	71 µg/kg
Benzo(a)pyrene	SW8270D	99 mg/kg-oc / 1600 µg/kg	210 mg/kg-oc / 1600 µg/kg	0.67 mg/kg-oc	1.9 mg/kg-oc	0.86 mg/kg-oc	38 µg/kg	88 µg/kg	130 µg/kg	0.74 mg/kg-oc	78 µg/kg
Benzo(g,h,i)perylene	SW8270D	31 mg/kg-oc / 670 µg/kg	78 mg/kg-oc / 720 µg/kg	0.41 J mg/kg-oc	1.7 mg/kg-oc	0.83 mg/kg-oc	35 µg/kg	81 µg/kg	71 µg/kg	0.57 mg/kg-oc	69 µg/kg
Benzofluoranthenes	SW8270D	230 mg/kg-oc / 3200 µg/kg	450 mg/kg-oc / 3600 µg/kg	1.8 mg/kg-oc	5.5 mg/kg-oc	2.3 mg/kg-oc	100 µg/kg	250 µg/kg	430 µg/kg	1.8 mg/kg-oc	200 µg/kg
Benzoic acid	SW8270D	650	650	310 J µg/kg	400 µg/kg	170 J µg/kg	200 J µg/kg	390 µg/kg	340 J µg/kg	160 J µg/kg	400 µg/kg

Table 2-2. Validated Analytical Results for Slip 4 Pre-Construction Boundary Area Samples

Chemical Name	Method	SQS	CSL	Sample ID	BD-1	BD-2	BD-3		BD-3 (field split)		BD-4	BD-5	BD-6	BD-7	BD-8
				Lab ID	SD0001	SD0002	SD0003	SD0004	SD0005	SD0006	SD0007	SD0008	SD0009		
				Sample Date	8/24/2011	8/24/2011	8/24/2011	8/24/2011	8/24/2011	8/24/2011	8/24/2011	8/24/2011	8/24/2011	8/24/2011	
Benzyl alcohol	SW8270D	57	73		280 µg/kg	320 µg/kg	160 µg/kg	170 µg/kg	230 µg/kg	340 µg/kg	170 µg/kg	380 µg/kg	380 µg/kg	380 µg/kg	
Bis(2-ethylhexyl) phthalate	SW8270D	47 mg/kg-oc / 1300 µg/kg	78 mg/kg-oc / 3100 µg/kg	1.5 U mg/kg-oc	5.9 U mg/kg-oc	2.9 U mg/kg-oc	120 U µg/kg	160 U µg/kg	230 µg/kg	280 µg/kg	2.3 U mg/kg-oc	280 µg/kg	4.9 mg/kg-oc		
Butylbenzyl phthalate	SW8270D	4.9 mg/kg-oc / 63 µg/kg	64 mg/kg-oc / 900 µg/kg	0.49 J mg/kg-oc	0.47 J mg/kg-oc	0.59 U mg/kg-oc	19 U µg/kg	49 µg/kg	9.5 J µg/kg	0.52 U mg/kg-oc	14 J µg/kg	0.28 J mg/kg-oc			
Chrysene	SW8270D	110 mg/kg-oc / 1400 µg/kg	460 mg/kg-oc / 2800 µg/kg	1.6 mg/kg-oc	2.8 mg/kg-oc	1.3 mg/kg-oc	56 µg/kg	220 µg/kg	260 µg/kg	1.2 mg/kg-oc	140 µg/kg	2.4 mg/kg-oc			
Di-n-octyl phthalate	SW8270D	58 mg/kg-oc / 6200 µg/kg	4500 mg/kg-oc / 6200 µg/kg	0.49 U mg/kg-oc	0.85 U mg/kg-oc	0.59 U mg/kg-oc	19 U µg/kg	19 U µg/kg	25 µg/kg	0.52 U mg/kg-oc	20 µg/kg	0.70 mg/kg-oc			
Dibenz(a,h)anthracene	SW8270D	12 mg/kg-oc / 230 µg/kg	33 mg/kg-oc / 230 µg/kg	0.49 U mg/kg-oc	0.55 J mg/kg-oc	0.59 U mg/kg-oc	10 J µg/kg	16 J µg/kg	33 µg/kg	0.52 U mg/kg-oc	24 µg/kg	0.54 mg/kg-oc			
Dibenzofuran	SW8270D	15 mg/kg-oc / 540 µg/kg	58 mg/kg-oc / 540 µg/kg	0.59 mg/kg-oc	0.85 U mg/kg-oc	0.59 U mg/kg-oc	19 U µg/kg	9.6 J µg/kg	21 µg/kg	0.52 U mg/kg-oc	16 J µg/kg	0.34 J mg/kg-oc			
Dibutyl phthalate	SW8270D	220 mg/kg-oc / 1400 µg/kg	1700 mg/kg-oc / 5100 µg/kg	0.49 U mg/kg-oc	0.85 U mg/kg-oc	0.59 U mg/kg-oc	19 U µg/kg	19 U µg/kg	19 U µg/kg	0.52 U mg/kg-oc	19 U µg/kg	0.52 U mg/kg-oc			
Diethyl phthalate	SW8270D	61 mg/kg-oc / 200 µg/kg	110 mg/kg-oc / 1200 µg/kg	1.2 U mg/kg-oc	2.1 U mg/kg-oc	1.5 U mg/kg-oc	47 U µg/kg	48 U µg/kg	48 U µg/kg	1.3 U mg/kg-oc	47 U µg/kg	1.3 U mg/kg-oc			
Dimethyl phthalate	SW8270D	53 mg/kg-oc / 71 µg/kg	53 mg/kg-oc / 160 µg/kg	0.49 U mg/kg-oc	0.85 U mg/kg-oc	0.59 U mg/kg-oc	19 U µg/kg	19 U µg/kg	19 U µg/kg	0.52 U mg/kg-oc	19 U µg/kg	0.52 U mg/kg-oc			
Fluoranthene	SW8270D	160 mg/kg-oc / 1700 µg/kg	1200 mg/kg-oc / 2500 µg/kg	4.6 mg/kg-oc	5.1 mg/kg-oc	2.0 mg/kg-oc	88 µg/kg	320 µg/kg	430 µg/kg	2.1 mg/kg-oc	210 µg/kg	3.9 mg/kg-oc			
Fluorene	SW8270D	23 mg/kg-oc / 540 µg/kg	79 mg/kg-oc / 540 µg/kg	0.62 mg/kg-oc	0.85 U mg/kg-oc	0.59 U mg/kg-oc	19 U µg/kg	12 J µg/kg	15 J µg/kg	0.52 U mg/kg-oc	10 J µg/kg	0.52 U mg/kg-oc			
HPAH	CALC	960 mg/kg-oc / 12000 µg/kg	5300 mg/kg-oc / 17000 µg/kg	15 J mg/kg-oc	25 J mg/kg-oc	11 mg/kg-oc	464 J µg/kg	1353 J µg/kg	1956 µg/kg	9.3 J mg/kg-oc	1008 µg/kg	20 mg/kg-oc			
Hexachlorobenzene	SW8270D	0.38 mg/kg-oc / 22 µg/kg	2.3 mg/kg-oc / 70 µg/kg	0.49 U mg/kg-oc	0.85 U mg/kg-oc	0.59 U mg/kg-oc	19 U µg/kg	19 U µg/kg	19 U µg/kg	0.52 U mg/kg-oc	19 U µg/kg	0.52 U mg/kg-oc			
Hexachlorobutadiene	SW8270D	3.9 mg/kg-oc / 11 µg/kg	6.2 mg/kg-oc / 120 µg/kg	2.5 U mg/kg-oc	4.2 U mg/kg-oc	2.9 U mg/kg-oc	95 U µg/kg	96 U µg/kg	95 U µg/kg	2.6 U mg/kg-oc	94 U µg/kg	2.5 U mg/kg-oc			
Hexachloroethane	SW8270D	NA	NA	19 U µg/kg	20 U µg/kg	20 U µg/kg	19 U µg/kg	19 U µg/kg	19 U µg/kg	19 U µg/kg	19 U µg/kg	20 U µg/kg			
Indeno(1,2,3-cd)pyrene	SW8270D	34 mg/kg-oc / 600 µg/kg	88 mg/kg-oc / 690 µg/kg	0.36 J mg/kg-oc	1.5 mg/kg-oc	0.71 mg/kg-oc	28 µg/kg	68 µg/kg	72 µg/kg	0.44 J mg/kg-oc	56 µg/kg	1.2 mg/kg-oc			
LPAH	CALC	370 mg/kg-oc / 5200 µg/kg	780 mg/kg-oc / 5200 µg/kg	4.9 J mg/kg-oc	2.9 J mg/kg-oc	1.2 J mg/kg-oc	57.5 J µg/kg	149 J µg/kg	209 J µg/kg	0.74 mg/kg-oc	147 J µg/kg	2.2 J mg/kg-oc			
N-Nitrosodiphenylamine	SW8270D	11 mg/kg-oc / 28 µg/kg	11 mg/kg-oc / 40 µg/kg	0.49 U mg/kg-oc	0.85 U mg/kg-oc	0.59 U mg/kg-oc	19 U µg/kg	19 U µg/kg	19 U µg/kg	0.52 U mg/kg-oc	19 U µg/kg	0.52 U mg/kg-oc			
Naphthalene	SW8270D	99 mg/kg-oc / 2100 µg/kg	170 mg/kg-oc / 2100 µg/kg	0.28 J mg/kg-oc	0.59 J mg/kg-oc	0.59 U mg/kg-oc	9.5 J µg/kg	12 J µg/kg	17 J µg/kg	0.52 U mg/kg-oc	20 µg/kg	0.39 J mg/kg-oc			
Pentachlorophenol	SW8270D	360	690	190 U µg/kg	200 U µg/kg	200 U µg/kg	190 U µg/kg	190 U µg/kg	190 U µg/kg	190 U µg/kg	190 U µg/kg	200 U µg/kg			
Phenanthrene	SW8270D	100 mg/kg-oc / 1500 µg/kg	480 mg/kg-oc / 1500 µg/kg	3.6 mg/kg-oc	1.7 mg/kg-oc	0.86 mg/kg-oc	36 µg/kg	91 µg/kg	120 µg/kg	0.74 mg/kg-oc	77 µg/kg	1.4 mg/kg-oc			
Phenol	SW8270D	420	1200	24 µg/kg	46 µg/kg	19 J µg/kg	19 µg/kg	32 µg/kg	29 µg/kg	16 J µg/kg	39 µg/kg	76 µg/kg			
Pyrene	SW8270D	1000 mg/kg-oc / 2600 µg/kg	1400 mg/kg-oc / 3300 µg/kg	3.9 mg/kg-oc	4.2 mg/kg-oc	1.8 mg/kg-oc	75 µg/kg	220 µg/kg	350 µg/kg	1.7 mg/kg-oc	160 µg/kg	3.1 mg/kg-oc			

Notes:

^a The cleanup screening level is as reported in the Lower Duwamish Waterway feasibility study.

-- = No calculation performed because total organic carbon was outside of range.

J = The associated numerical value is the approximate concentration.

U = Not detected above the reported sample quantitation limit.

Results were OC-normalized for samples with TOC concentrations ranging from 0.5 to 4.0%. Results for samples that had TOC concentrations below or above this range were compared to SQS/CSL values.



Result exceeds LAET/SQS value.
Result exceeds 2LAET/CSL value.

Table 2-3. Validated Analytical Results for Slip 4 Post-construction Boundary Area Samples

		Sample ID	BD-1		BD-2		BD-3		BD-4		BD-5		BD-6		BD-7		BD-8	
		Lab ID	SD0041		SD0042		SD0043		SD0044		SD0045		SD0046		SD0047		SD0048	
		Sample Date	2/2/2012		2/2/2012		2/2/2012		2/2/2012		2/1/2012		2/1/2012		2/1/2012		2/1/2012	
Chemical Name	Method	SQS	CSL															
PCB Aroclors																		
Aroclor 1016	SW8082			19 U	µg/kg	20 U	µg/kg	19 U	µg/kg	19 U	µg/kg							
Aroclor 1221	SW8082			19 U	µg/kg	20 U	µg/kg	19 U	µg/kg	19 U	µg/kg							
Aroclor 1232	SW8082			19 U	µg/kg	20 U	µg/kg	19 U	µg/kg	19 U	µg/kg							
Aroclor 1242	SW8082			19 U	µg/kg	20 U	µg/kg	19 U	µg/kg	19 U	µg/kg							
Aroclor 1248	SW8082			340	µg/kg	220	µg/kg	110	µg/kg	340	µg/kg	180	µg/kg	180	µg/kg	230	µg/kg	
Aroclor 1254	SW8082			680	µg/kg	420	µg/kg	200	µg/kg	950	µg/kg	360	µg/kg	330	µg/kg	390	µg/kg	
Aroclor 1260	SW8082			190	µg/kg	120	µg/kg	100	µg/kg	270	µg/kg	110	µg/kg	120	µg/kg	110	µg/kg	
Total Aroclors	Calculated	130	1300 ^a	1200	µg/kg	760	µg/kg	410	µg/kg	1600	µg/kg	650	µg/kg	630	µg/kg	680	µg/kg	
Total Aroclors OC	Calculated	12	65	48	mg/kg-oc	29	mg/kg-oc	14	mg/kg-oc	63	mg/kg-oc	30	mg/kg-oc	30	mg/kg-oc	29	mg/kg-oc	
Conventionals																		
Total organic carbon	Plumb1981			2.52	percent	2.58	percent	2.92	percent	2.53	percent	2.15	percent	2.08	percent	2.37	percent	
Total solids	E160.3			48.2	percent	45.4	percent	41.1	percent	49.5	percent	45.2	percent	43.7	percent	42.6	percent	
Metals																		
Arsenic	SW6010B	57	93	20	mg/kg	20	mg/kg	10	mg/kg	10	mg/kg	20	mg/kg	20	mg/kg	10	mg/kg	
Cadmium	SW6010B	5.1	6.7	0.8	mg/kg	0.8	mg/kg	0.8	mg/kg	0.7	mg/kg	0.8	mg/kg	0.8	mg/kg	0.6	mg/kg	
Chromium	SW6010B	260	270	37	mg/kg	35	mg/kg	34	mg/kg	32	mg/kg	35	mg/kg	36	mg/kg	35	mg/kg	
Copper	SW6010B	390	390	65.4	mg/kg	64.7	mg/kg	64.7	mg/kg	68.1	mg/kg	63.1	mg/kg	79.9	mg/kg	68.6	mg/kg	
Lead	SW6010B	450	530	32	mg/kg	28	mg/kg	27	mg/kg	33	mg/kg	25	mg/kg	26	mg/kg	24	mg/kg	
Mercury	SW7471	0.41	0.59	0.13 J	mg/kg	0.14 J	mg/kg	0.15 J	mg/kg	0.12 J	mg/kg	0.12 J	mg/kg	0.11 J	mg/kg	0.12 J	mg/kg	
Silver	SW6010B	6.1	6.1	0.6 U	mg/kg	0.7 U	mg/kg	0.7 U	mg/kg	0.6 U	mg/kg	0.6 U	mg/kg	0.7 U	mg/kg	0.5 U	mg/kg	
Zinc	SW6010B	410	960	159 J	mg/kg	116 J	mg/kg	118 J	mg/kg	112 J	mg/kg	111 J	mg/kg	112 J	mg/kg	119 J	mg/kg	
SVOCs																		
1,2,4-Trichlorobenzene	SW8270D	0.81 mg/kg-oc / 31 µg/kg	1.8 mg/kg-oc / 51 µg/kg	0.79 U	mg/kg-oc	0.78 U	mg/kg-oc	0.68 U	mg/kg-oc	0.79 U	mg/kg-oc	0.88 U	mg/kg-oc	0.91 U	mg/kg-oc	0.84 U	mg/kg-oc	
1,2-Dichlorobenzene	SW8270D	2.3 mg/kg-oc / 35 µg/kg	2.3 mg/kg-oc / 50 µg/kg	0.79 U	mg/kg-oc	0.78 U	mg/kg-oc	0.68 U	mg/kg-oc	0.79 U	mg/kg-oc	0.88 U	mg/kg-oc	0.91 U	mg/kg-oc	0.84 U	mg/kg-oc	
1,3-Dichlorobenzene	SW8270D	170	170	20 U	µg/kg	19 U	µg/kg	19 U	µg/kg	20 U	µg/kg							
1,4-Dichlorobenzene	SW8270D	3.1 mg/kg-oc / 110 µg/kg	9 mg/kg-oc / 110 µg/kg	0.79 U	mg/kg-oc	0.78 U	mg/kg-oc	0.68 U	mg/kg-oc	0.79 U	mg/kg-oc	0.88 U	mg/kg-oc	0.91 U	mg/kg-oc	0.84 U	mg/kg-oc	
1-Methylnaphthalene	SW8270D	NA	NA	680	µg/kg	35	µg/kg	130	µg/kg	20 U	µg/kg	42	µg/kg	30	µg/kg	32	µg/kg	
2,4-Dimethylphenol	SW8270D	29	29	20 UJ	µg/kg	20 UJ	µg/kg	20 UJ	µg/kg	19 UJ	µg/kg	19 UJ	µg/kg	19 UJ	µg/kg	20 UJ	µg/kg	
2-Methylnaphthalene	SW8270D	38 mg/kg-oc / 670 µg/kg	64 mg/kg-oc / 670 µg/kg	48	mg/kg-oc	2.5	mg/kg-oc	8.2	mg/kg-oc	1.5	mg/kg-oc	3.3	mg/kg-oc	2.6	mg/kg-oc	2.4	mg/kg-oc	
2-Methylphenol	SW8270D	63	63	20 U	µg/kg	20 U	µg/kg	20 U	µg/kg	19 U	µg/kg	18 J	µg/kg	16 J	µg/kg	17 J	µg/kg	
4-Methylphenol	SW8270D	670	670	25 J	µg/kg	19 J	µg/kg	23 J	µg/kg	18 J	µg/kg	16 J	µg/kg	17 J	µg/kg	18 J	µg/kg	
Acenaphthene	SW8270D	16 mg/kg-oc / 500 µg/kg	57 mg/kg-oc / 500 µg/kg	67	mg/kg-oc	6.6	mg/kg-oc	23	mg/kg-oc	4.3	mg/kg-oc	9.8	mg/kg-oc	7.7	mg/kg-oc	6.8	mg/kg-oc	
Acenaphthylene	SW8270D	66 mg/kg-oc / 1300 µg/kg	66 mg/kg-oc / 1300 µg/kg	1.9	mg/kg-oc	0.78 U	mg/kg-oc	0.68 U	mg/kg-oc	0.75 J	mg/kg-oc	0.79 J	mg/kg-oc	0.58 J	mg/kg-oc	0.63 J	mg/kg-oc	
Anthracene	SW8270D	220 mg/kg-oc / 960 µg/kg	1200 mg/kg-oc / 960 µg/kg	25	mg/kg-oc	5.8	mg/kg-oc	14	mg/kg-oc	7.1	mg/kg-oc	11	mg/kg-oc	7.7	mg/kg-oc	6.3	mg/kg-oc	
Benzo(a)anthracene	SW8270D	110 mg/kg-oc / 1300 µg/kg	270 mg/kg-oc / 1600 µg/kg	28	mg/kg-oc	10	mg/kg-oc	14	mg/kg-oc	13	mg/kg-oc	17	mg/kg-oc	13	mg/kg-oc	11	mg/kg-oc	
Benzo(a)pyrene	SW8270D	99 mg/kg-oc / 1600 µg/kg	210 mg/kg-oc / 1600 µg/kg	15	mg/kg-oc	7.0	mg/kg-oc	7.2	mg/kg-oc	9.9	mg/kg-oc	8.8	mg/kg-oc	7.7	mg/kg-oc	6.8	mg/kg-oc	
Benzo(g,h,i)perylene	SW8270D	31 mg/kg-oc / 670 µg/kg	78 mg/kg-oc / 720 µg/kg	5.6	mg/kg-oc	4.3	mg/kg-oc	2.7	mg/kg-oc	3.9	mg/kg-oc	4.0	mg/kg-oc	4.4	mg/kg-oc	3.7	mg/kg-oc	
Benzofluoranthenes	SW8270D	230 mg/kg-oc / 3200 µg/kg	450 mg/kg-oc / 3600 µg/kg	34	mg/kg-oc	16	mg/kg-oc	17	mg/kg-oc	22	mg/kg-oc	19	mg/kg-oc	18	mg/kg-oc	16	mg/kg-oc	

Table 2-3. Validated Analytical Results for Slip 4 Post-construction Boundary Area Samples

Chemical Name	Method	SQS	CSL																												
			BD-1			BD-2			BD-3			BD-4			BD-5			BD-6			BD-7			BD-8							
			Lab ID	SD0041	Sample Date	2/2/2012	Lab ID	SD0042	Sample Date	2/2/2012	Lab ID	SD0043	Sample Date	2/2/2012	Lab ID	SD0044	Sample Date	2/2/2012	Lab ID	SD0045	Sample Date	2/1/2012	Lab ID	SD0046	Sample Date	2/1/2012	Lab ID	SD0047	Sample Date	2/1/2012	Lab ID
Benzoic acid	SW8270D	650	650	140 J	µg/kg	170 J	µg/kg	270 J	µg/kg	120 J	µg/kg	120 J	µg/kg	120 J	µg/kg	170 J	µg/kg	170 J	µg/kg	170 J	µg/kg	170 J	µg/kg	130 J	µg/kg						
Benzyl alcohol	SW8270D	57	73	210 J	µg/kg	180 J	µg/kg	220 J	µg/kg	160 J	µg/kg	200 J	µg/kg	140 J	µg/kg	190 J	µg/kg	190 J	µg/kg	190 J	µg/kg	190 J	µg/kg	190 J	µg/kg						
Bis(2-ethylhexyl) phthalate	SW8270D	47 mg/kg-oc / 1300 µg/kg	78 mg/kg-oc / 3100 µg/kg	22	mg/kg-oc	16	mg/kg-oc	13	mg/kg-oc	17	mg/kg-oc	14	mg/kg-oc	20	mg/kg-oc	17	mg/kg-oc	17	mg/kg-oc	17	mg/kg-oc	17	mg/kg-oc	16	mg/kg-oc						
Butylbenzyl phthalate	SW8270D	4.9 mg/kg-oc / 63 µg/kg	64 mg/kg-oc / 900 µg/kg	0.75 J	mg/kg-oc	0.66 J	mg/kg-oc	0.75	mg/kg-oc	0.59 J	mg/kg-oc	0.56 J	mg/kg-oc	0.67 J	mg/kg-oc	0.68 J	mg/kg-oc	0.68 J	mg/kg-oc	0.68 J	mg/kg-oc	0.50 J	mg/kg-oc								
Chrysene	SW8270D	110 mg/kg-oc / 1400 µg/kg	460 mg/kg-oc / 2800 µg/kg	34	mg/kg-oc	13	mg/kg-oc	18	mg/kg-oc	17	mg/kg-oc	22	mg/kg-oc	17	mg/kg-oc	15	mg/kg-oc	15	mg/kg-oc	15	mg/kg-oc	13	mg/kg-oc								
Di-n-octyl phthalate	SW8270D	58 mg/kg-oc / 6200 µg/kg	4500 mg/kg-oc / 6200 µg/kg	2.5	mg/kg-oc	1.2	mg/kg-oc	0.79	mg/kg-oc	1.6	mg/kg-oc	6.5	mg/kg-oc	2.3	mg/kg-oc	1.9	mg/kg-oc	1.9	mg/kg-oc	1.9	mg/kg-oc	1.6	mg/kg-oc								
Dibenzo(a,h)anthracene	SW8270D	12 mg/kg-oc / 230 µg/kg	33 mg/kg-oc / 230 µg/kg	2.7	mg/kg-oc	1.7	mg/kg-oc	1.2	mg/kg-oc	1.7	mg/kg-oc	1.3	mg/kg-oc	1.8	mg/kg-oc	1.6	mg/kg-oc	1.6	mg/kg-oc	1.8	mg/kg-oc										
Dibenzofuran	SW8270D	15 mg/kg-oc / 540 µg/kg	58 mg/kg-oc / 540 µg/kg	52	mg/kg-oc	6.2	mg/kg-oc	21	mg/kg-oc	3.9	mg/kg-oc	8.4	mg/kg-oc	7.2	mg/kg-oc	6.3	mg/kg-oc	6.3	mg/kg-oc	6.3	mg/kg-oc	2.4	mg/kg-oc								
Diбуyl phthalate	SW8270D	220 mg/kg-oc / 1400 µg/kg	1700 mg/kg-oc / 5100 µg/kg	0.79 U	mg/kg-oc	0.78 U	mg/kg-oc	0.62 J	mg/kg-oc	0.79 U	mg/kg-oc	0.88 U	mg/kg-oc	0.67 J	mg/kg-oc	0.84 U	mg/kg-oc	0.84 U	mg/kg-oc	0.84 U	mg/kg-oc	0.95 U	mg/kg-oc								
Diethyl phthalate	SW8270D	61 mg/kg-oc / 200 µg/kg	110 mg/kg-oc / 1200 µg/kg	1.9 U	mg/kg-oc	1.9 U	mg/kg-oc	1.7 U	mg/kg-oc	1.9 U	mg/kg-oc	2.2 U	mg/kg-oc	2.3 U	mg/kg-oc	2.1 U	mg/kg-oc	2.1 U	mg/kg-oc	2.1 U	mg/kg-oc	2.4 U	mg/kg-oc								
Dimethyl phthalate	SW8270D	53 mg/kg-oc / 171 µg/kg	53 mg/kg-oc / 160 µg/kg	0.79 U	mg/kg-oc	0.78 U	mg/kg-oc	0.68 U	mg/kg-oc	0.79 U	mg/kg-oc	0.88 U	mg/kg-oc	0.91 U	mg/kg-oc	0.84 U	mg/kg-oc	0.95 U	mg/kg-oc	0.95 U	mg/kg-oc										
Fluoranthene	SW8270D	160 mg/kg-oc / 1700 µg/kg	1200 mg/kg-oc / 2500 µg/kg	190	mg/kg-oc	38	mg/kg-oc	92	mg/kg-oc	47	mg/kg-oc	65	mg/kg-oc	53	mg/kg-oc	42	mg/kg-oc	33	mg/kg-oc												
Fluorene	SW8270D	23 mg/kg-oc / 540 µg/kg	79 mg/kg-oc / 540 µg/kg	67	mg/kg-oc	8.9	mg/kg-oc	28	mg/kg-oc	6.7	mg/kg-oc	15	mg/kg-oc	11	mg/kg-oc	9.7	mg/kg-oc	4.0	mg/kg-oc												
HPAH	CALC	960 mg/kg-oc / 12000 µg/kg	5300 mg/kg-oc / 17000 µg/kg	440	mg/kg-oc	120	mg/kg-oc	210	mg/kg-oc	150.00	mg/kg-oc	200	mg/kg-oc	160	mg/kg-oc	130	mg/kg-oc	120	mg/kg-oc												
Hexachlorobenzene	SW8270D	0.38 mg/kg-oc / 22 µg/kg	2.3 mg/kg-oc / 70 µg/kg	0.79 U	mg/kg-oc	0.78 U	mg/kg-oc	0.68 U	mg/kg-oc	0.79 U	mg/kg-oc	0.88 U	mg/kg-oc	0.91 U	mg/kg-oc	0.84 U	mg/kg-oc	0.95 U	mg/kg-oc												
Hexachlorobutadiene	SW8270D	3.9 mg/kg-oc / 11 µg/kg	6.2 mg/kg-oc / 120 µg/kg	0.39 UJ	mg/kg-oc	0.38 UJ	mg/kg-oc	0.33 UJ	mg/kg-oc	0.39 UJ	mg/kg-oc	0.45 UJ	mg/kg-oc	0.46 UJ	mg/kg-oc	0.41 UJ	mg/kg-oc	0.48 UJ	mg/kg-oc												
Hexachloroethane	SW8270D	NA	NA	20 U	µg/kg	20 U	µg/kg	20 U	µg/kg	19 U	µg/kg	19 U	µg/kg	20 U	µg/kg	19 U	µg/kg	19 U	µg/kg	19 U	µg/kg										
Indeno(1,2,3-cd)pyrene	SW8270D	34 mg/kg-oc / 600 µg/kg	88 mg/kg-oc / 690 µg/kg	5.6	mg/kg-oc	3.6	mg/kg-oc	2.8	mg/kg-oc	3.6	mg/kg-oc	3.8	mg/kg-oc	3.9	mg/kg-oc	3.5	mg/kg-oc	3.7	mg/kg-oc												
LPAH	CALC	370 mg/kg-oc / 5200 µg/kg	780 mg/kg-oc / 5200 µg/kg	490	mg/kg-oc	60 J	mg/kg-oc	200	mg/kg-oc	51 J	mg/kg-oc	110 J	mg/kg-oc	78 J	mg/kg-oc	65 J	mg/kg-oc	31 J	mg/kg-oc												
N-Nitrosodiphenylamine	SW8270D	11 mg/kg-oc / 28 µg/kg	11 mg/kg-oc / 40 µg/kg	1.3	mg/kg-oc	0.78 U	mg/kg-oc	0.82	mg/kg-oc	0.79 U	mg/kg-oc	0.88 U	mg/kg-oc	0.91 U	mg/kg-oc	0.84 U	mg/kg-oc	0.95 U	mg/kg-oc												
Naphthalene	SW8270D	99 mg/kg-oc / 2100 µg/kg	170 mg/kg-oc / 2100 µg/kg	63	mg/kg-oc	2.3	mg/kg-oc	6.5	mg/kg-oc	1.7	mg/kg-oc	5.1	mg/kg-oc	3.4	mg/kg-oc	2.9	mg/kg-oc	1.4	mg/kg-oc												
Pentachlorophenol	SW8270D	360	690	200 U	µg/kg	200 U	µg/kg	200 U	µg/kg	200 U	µg/kg	190 U	µg/kg	190 U	µg/kg	200 U	µg/kg	190 U	µg/kg												
Phenanthrene	SW8270D	100 mg/kg-oc / 1500 µg/kg	480 mg/kg-oc / 1500 µg/kg	262	mg/kg-oc	36 J	mg/kg-oc	134	mg/kg-oc	30	mg/kg-oc	70	mg/kg-oc	48	mg/kg-oc	39	mg/kg-oc	17	mg/kg-oc												
Phenol	SW8270D	420	1200	25	µg/kg	25	µg/kg	35	µg/kg	17 J	µg/kg	23	µg/kg	20	µg/kg	23	µg/kg	11 J	µg/kg												
Pyrene	SW8270D	1000 mg/kg-oc / 2600 µg/kg	1400 mg/kg-oc / 3300 µg/kg	127	mg/kg-oc	29	mg/kg-oc	51	mg/kg-oc	36	mg/kg-oc	56	mg/kg-oc	38	mg/kg-oc	31	mg/kg-oc	26	mg/kg-oc												

Notes:

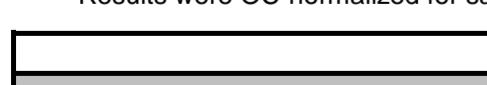
^a The cleanup screening level is as reported in the Lower Duwamish Waterway feasibility study.

J = The associated numerical value is the approximate concentration.

U = Not detected above the reported sample quantitation limit.

UJ = The analyte was not detected above the reported sample quantitation limit. However, the reported quantitation limit is approximate.

Results were OC-normalized for samples with TOC concentrations ranging from 0.5 to 4.0%. Results for samples that had TOC concentrations below or above this range were compared to SQS/CSL values.



Result exceeds LAET/SQS value.

Result exceeds 2LAET/CSL value.

Table 2-4. Validated Analytical Results for Slip 4 Post-placement Boundary Area Samples

			Sample ID Lab ID	BD-1 SD0056	BD-2 SD0054	BD-3 SD0049	BD-3 (field split) SD0050	BD-4 SD0057	BD-5 SD0052	BD-6 SD0051	BD-7 SD0053	BD-8 SD0055
Chemical Name	Method	Unit	SQS	CSL								
PCB Aroclors												
Aroclor 1016	SW8082	µg/kg		3.7 U	3.9 U	3.9 U	3.7 U	3.7 U	4 U	3.9 U	3.8 U	3.8 U
Aroclor 1221	SW8082	µg/kg		16 U	14 U	12 U	17 U	3.7 U	4 U	3.9 U	3.8 U	3.8 U
Aroclor 1232	SW8082	µg/kg		3.7 U	3.9 U	3.9 U	3.7 U	3.7 U	4 U	3.9 U	3.8 U	3.8 U
Aroclor 1242	SW8082	µg/kg		3.7 U	3.9 U	3.9 U	3.7 U	3.7 U	4 U	3.9 U	3.8 U	3.8 U
Aroclor 1248	SW8082	µg/kg		3.7 U	3.9 U	3.9 U	3.7 U	3.7 U	4 U	3.9 U	3.8 U	3.8 U
Aroclor 1254	SW8082	µg/kg		6.8	3.9 U	3.9 U	3.7 U	3.7 U	4 U	3.9 U	3.8 U	3.8 U
Aroclor 1260	SW8082	µg/kg			3.7 U	3.9 U	3.9 U	3.7 U	3.7 U	4 U	3.9 U	3.8 U
Total Aroclors	Calculated	µg/kg	130	1300 ^a	6.8	14 U	12 U	17 U	3.7 U	4 U	3.9 U	3.8 U
Total Aroclors OC	Calculated	mg/kg-oc	12	65	--	--	--	--	--	--	--	--
Conventionals												
Total organic carbon	Plumb 1981	percent			0.241	0.162	0.191	0.124	0.154	0.085	0.171	0.073
Total solids	E160.3	percent			83	89.5	88	90.5	94.3	89.5	90.6	94.6
												0.099

Notes:

^a The cleanup screening level is as reported in the Lower Duwamish Waterway feasibility study.

-- = No calculation performed because total organic carbon was outside of range.

U = Not detected above the reported sample quantitation limit.

Results were OC-normalized for samples with TOC concentrations ranging from 0.5 to 4.0%. Results for samples that had TOC concentrations below or above this range were compared to SQS/CSL values.

Table 2-5. Validated Analytical Results for Slip 4 Post-dredge/Excavation Documentation Samples

	Sample ID Lab ID Sample Date	PE-1 SD0018 11/14/2011	PE-2 SD0010 11/16/2011	PE-3 SD0023 11/14/2011	PE-4 SD0011 11/16/2011	PE-5 (field split) SD0012 11/14/2011	PE-6 SD0013 11/14/2011	PE-7 SD0014 11/14/2011	PE-8 SD0019 11/14/2011	PE-9 SD0015 11/14/2011	PE-10 SD0020 11/14/2011	PE-11 SD0016 11/14/2011	PE-12 SD0021 11/14/2011	PE-13 SD0017 11/14/2011	PE-14 SD0022 11/14/2011			
Chemical Name	Method	SQS	CSL															
PCB Aroclors																		
Aroclor 1016	SW8082	3.5 U ug/kg	1800 U ug/kg	37 U ug/kg	1200 U ug/kg	38 U ug/kg	200 U ug/kg	3.9 U ug/kg	39 U ug/kg	38 U ug/kg	40 U ug/kg	39 U ug/kg	38 U ug/kg	39 U ug/kg	3.7 U ug/kg			
Aroclor 1221	SW8082	3.5 U ug/kg	1800 U ug/kg	37 U ug/kg	1200 U ug/kg	38 U ug/kg	200 U ug/kg	3.9 U ug/kg	39 U ug/kg	38 U ug/kg	40 U ug/kg	39 U ug/kg	38 U ug/kg	39 U ug/kg	3.7 U ug/kg			
Aroclor 1232	SW8082	11 U ug/kg	1800 U ug/kg	37 U ug/kg	1200 U ug/kg	38 U ug/kg	200 U ug/kg	3.9 U ug/kg	39 U ug/kg	38 U ug/kg	40 U ug/kg	39 U ug/kg	38 U ug/kg	39 U ug/kg	3.7 U ug/kg			
Aroclor 1242	SW8082	3.5 U ug/kg	1800 U ug/kg	37 U ug/kg	1200 U ug/kg	38 U ug/kg	200 U ug/kg	3.9 U ug/kg	39 U ug/kg	38 U ug/kg	40 U ug/kg	39 U ug/kg	38 U ug/kg	38 U ug/kg	3.7 U ug/kg			
Aroclor 1248	SW8082	3.5 U ug/kg	22000 U ug/kg	55 U ug/kg	7200 U ug/kg	150 U ug/kg	200 U ug/kg	3.9 U ug/kg	160 U ug/kg	38 U ug/kg	400 U ug/kg	78 U ug/kg	130 U ug/kg	120 U ug/kg	96 U ug/kg			
Aroclor 1254	SW8082	7.3 ug/kg	26000 ug/kg	390 ug/kg	23000 ug/kg	820 ug/kg	1100 ug/kg	12 ug/kg	420 ug/kg	220 ug/kg	1300 ug/kg	320 ug/kg	750 ug/kg	980 ug/kg	3.7 ug/kg			
Aroclor 1260	SW8082	4.7 ug/kg	4600 ug/kg	98 ug/kg	1700 U ug/kg	390 ug/kg	270 ug/kg	25 ug/kg	68 ug/kg	78 ug/kg	230 J ug/kg	210 ug/kg	610 ug/kg	1100 ug/kg	7.4 ug/kg			
Total Aroclors	Calculated	130	1300 ^a mg/kg	12 ug/kg	31000 ug/kg	490 ug/kg	23000 ug/kg	1200 ug/kg	1400 ug/kg	25 ug/kg	490 ug/kg	300 ug/kg	1500 J ug/kg	530 ug/kg	1400 ug/kg			
Total Aroclors OC	Calculated	12	65	--	mg/kg-oc	42 mg/kg-oc	1300 mg/kg-oc	69 mg/kg-oc	98 mg/kg-oc	3.0 mg/kg-oc	51 mg/kg-oc	11 mg/kg-oc	71 mg/kg-oc	16 mg/kg-oc	53 mg/kg-oc	65 mg/kg-oc		
Conamentals																		
Total organic carbon	Plumb1981	0.361 J percent	4.86 J percent	1.18 J percent	1.71 J percent	1.74 J percent	1.43 J percent	0.829 J percent	0.952 J percent	2.62 J percent	2.1 J percent	3.39 J percent	2.63 J percent	3.25 J percent	1.57 J percent			
Total solids	E160.3	91 percent	40.9 percent	69.7 percent	75.5 percent	74.6 percent	88.1 percent	72.8 percent	91.4 percent	74.1 percent	92.6 percent	84.7 percent	92 percent	74.6 percent	87.7 percent	1.32 J percent		
Metals																		
Arsenic	SW6010B	57 mg/kg	93 mg/kg	5 U mg/kg	20 mg/kg	10 mg/kg	7 mg/kg	6 U mg/kg	7 mg/kg	7 mg/kg	9 mg/kg	6 mg/kg	10 mg/kg	6 U mg/kg	6 mg/kg			
Cadmium	SW6010B	5.1 mg/kg	6.7 mg/kg	0.2 U mg/kg	2.4 mg/kg	0.5 mg/kg	1 mg/kg	0.3 U mg/kg	0.4 mg/kg	0.3 U mg/kg	0.5 mg/kg	0.3 mg/kg	0.4 mg/kg	0.2 U mg/kg	0.3 mg/kg			
Chromium	SW6010B	260 mg/kg	270 mg/kg	26.3 mg/kg	55 mg/kg	23.2 mg/kg	23 mg/kg	15.7 mg/kg	19.7 mg/kg	15.7 mg/kg	28.4 mg/kg	32.2 mg/kg	34.7 mg/kg	33.9 mg/kg	15.7 mg/kg			
Copper	SW6010B	390 mg/kg	390 mg/kg	15.5 mg/kg	113 mg/kg	35.4 mg/kg	33.7 mg/kg	22.4 mg/kg	25.6 mg/kg	23.2 mg/kg	36.1 mg/kg	30.3 mg/kg	42.3 mg/kg	19.2 mg/kg	30.6 mg/kg			
Lead	SW6010B	450 mg/kg	530 mg/kg	6 mg/kg	222 mg/kg	46 mg/kg	50 mg/kg	25 mg/kg	35 mg/kg	15 mg/kg	25 mg/kg	51 mg/kg	26 mg/kg	23 mg/kg	33 mg/kg			
Mercury	SW7471	0.41 mg/kg	0.59 mg/kg	0.02 mg/kg	0.69 mg/kg	0.05 mg/kg	0.15 mg/kg	0.04 mg/kg	0.04 mg/kg	0.11 mg/kg	0.06 mg/kg	0.19 mg/kg	0.34 mg/kg	0.12 mg/kg	0.07 mg/kg			
Silver	SW6010B	6.1 mg/kg	6.1 mg/kg	0.3 U mg/kg	4.9 mg/kg	0.4 U mg/kg	2 mg/kg	0.4 U mg/kg	0.3 U mg/kg	0.4 U mg/kg	0.3 U mg/kg	0.3 U mg/kg	0.3 U mg/kg	0.3 U mg/kg	0.3 U mg/kg			
Zinc	SW6010B	410 mg/kg	960 mg/kg	46 mg/kg	339 mg/kg	118 mg/kg	106 mg/kg	56 mg/kg	62 mg/kg	108 mg/kg	83 mg/kg	99 mg/kg	96 mg/kg	88 mg/kg	99 mg/kg			
SVCos																		
1,2,4-Trichlorobenzene	SW8270D	0.81 mg/kg-oc / 31 ug/kg	1.8 mg/kg-oc / 51 ug/kg	18 U ug/kg	59 U ug/kg	4.7 U mg/kg-oc	1.1 U mg/kg-oc	1.1 U mg/kg-oc	1.3 U mg/kg-oc	2.2 U mg/kg-oc	1.9 U mg/kg-oc	2.2 U mg/kg-oc	2.8 U mg/kg-oc	1.7 U mg/kg-oc	2.2 U mg/kg-oc	1.8 U mg/kg-oc		
1,2-Dichlorobenzene	SW8270D	2.3 mg/kg-oc / 35 ug/kg	2.3 mg/kg-oc / 50 ug/kg	18 U ug/kg	59 U ug/kg	4.7 U mg/kg-oc	1.1 U mg/kg-oc	1.1 U mg/kg-oc	1.3 U mg/kg-oc	2.2 U mg/kg-oc	1.9 U mg/kg-oc	2.2 U mg/kg-oc	2.8 U mg/kg-oc	1.7 U mg/kg-oc	2.2 U mg/kg-oc	1.8 U mg/kg-oc		
1,3-Dichlorobenzene	SW8270D	170 mg/kg	170 mg/kg	18 U ug/kg	59 U ug/kg	4.7 U mg/kg-oc	1.1 U mg/kg-oc	1.1 U mg/kg-oc	1.3 U mg/kg-oc	2.2 U mg/kg-oc	1.9 U mg/kg-oc	2.2 U mg/kg-oc	2.8 U mg/kg-oc	1.7 U mg/kg-oc	2.2 U mg/kg-oc	1.8 U mg/kg-oc		
1,4-Dichlorobenzene	SW8270D	3.1 mg/kg-oc / 110 ug/kg	9 mg/kg-oc / 110 ug/kg	18 U ug/kg	59 U ug/kg	4.7 U mg/kg-oc	1.1 U mg/kg-oc	1.1 U mg/kg-oc	1.3 U mg/kg-oc	2.2 U mg/kg-oc	1.9 U mg/kg-oc	2.2 U mg/kg-oc	2.8 U mg/kg-oc	1.7 U mg/kg-oc	2.2 U mg/kg-oc	1.8 U mg/kg-oc		
1-Methylnaphthalene	SW8270D	NA mg/kg	NA mg/kg	18 U ug/kg	150 mg/kg	77 ug/kg	44 ug/kg	12 J ug/kg	12 J ug/kg	16 J ug/kg	18 U ug/kg	58 U ug/kg	58 U ug/kg	82 ug/kg	46 J ug/kg	59 U ug/kg	19 U ug/kg	
2,4-Dimethylphenol	SW8270D	29 mg/kg	29 mg/kg	37 U ug/kg	120 U ug/kg	110 U ug/kg	39 U ug/kg	38 U ug/kg	37 U ug/kg	37 U ug/kg	120 U ug/kg	120 U ug/kg						
2-Methylnaphthalene	SW8270D	38 mg/kg-oc / 670 ug/kg	64 mg/kg-oc / 670 ug/kg	18 U ug/kg	260 mg/kg	6.5 mg/kg-oc	3.6 mg/kg-oc	0.92 J mg/kg-oc	1.0 J mg/kg-oc	2.4 mg/kg-oc	1.5 J mg/kg-oc	1.2 J mg/kg-oc	10 mg/kg-oc	2.9 mg/kg-oc	1.2 J mg/kg-oc	1.8 U mg/kg-oc	1.2 U mg/kg-oc	1.4 U mg/kg-oc
2-Methylphenol	SW8270D	63 mg/kg	63 mg/kg	18 U ug/kg	59 U ug/kg	55 U ug/kg	19 U ug/kg	19 U ug/kg	19 U ug/kg	18 U ug/kg	58 U ug/kg	58 U ug/kg	58 U ug/kg	58 U ug/kg	58 U ug/kg	59 U ug/kg	18 U ug/kg	
4-Methylphenol	SW8270D	670 mg/kg	670 mg/kg	37 U ug/kg	44 J ug/kg	39 U ug/kg	110 U ug/kg	110 U ug/kg	110 U ug/kg	120 U ug/kg	120 U ug/kg	120 U ug/kg	120 U ug/kg	120 U ug/kg	120 U ug/kg	38 U ug/kg	37 U ug/kg	
Acenaphthene	SW8270D	16 mg/kg-oc / 500 ug/kg	57 mg/kg-oc / 500 ug/kg	18 U ug/kg	460 mg/kg	6.4 mg/kg-oc	1.5 mg/kg-oc	1.7 mg/kg-oc	2.2 U mg/kg-oc	2.5 mg/kg-oc	5.7 mg/kg-oc	41 J mg/kg-oc	6.2 mg/kg-oc	1.2 J mg/kg-oc	1.8 U mg/kg-oc	1.2 U mg/kg-oc	1.4 U mg/kg-oc	
Acenaphthylene	SW8270D	66 mg/kg-oc / 1300 ug/kg	66 mg/kg-oc / 1300 ug/kg	18 U ug/kg	38 J ug/kg	4.7 U mg/kg-oc	1.1 U											

Table 2-5. Validated Analytical Results for Slip 4 Post-dredge/Excavation Documentation Samples

	Sample ID Lab ID	PE-1 SD0018	PE-2 SD0010	PE-3 SD0023	PE-4 SD0011	PE-5 SD0012	PE-5 (field split) SD0013	PE-6 SD0024	PE-7 SD0014	PE-8 SD0019	PE-9 SD0015	PE-10 SD0020	PE-11 SD0016	PE-12 SD0021	PE-13 SD0017	PE-14 SD0022
	Sample Date	11/14/2011	11/16/2011	11/14/2011	11/16/2011	11/14/2011	11/14/2011	11/14/2011	11/14/2011	11/14/2011	11/14/2011	11/14/2011	11/14/2011	11/14/2011	11/14/2011	11/14/2011
Chemical Name	Method	SQS	CSL													

^a The cleanup screening level is as reported in the Lower Duwamish Waterway feasibility study.

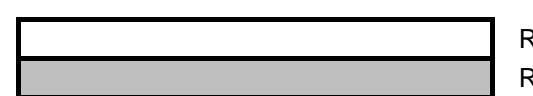
-- = No calculation performed because total organic carbon was outside of range.

J = The associated numerical value is the approximate concentration.

U = Not detected above the reported sample quantitation limit.

UU = The analyte was not detected above the reported sample quantitation limit. However, the reported quantitation limit is approximate.

Results were OC-normalized for samples with TOC concentrations ranging from 0.5 to 4.0%. Results for samples that had TOC concentrations below or above this range were compared to SQS/CSL values.



Result exceeds LAET/SQS value.

Result exceeds 2LAET/CSL value.

Table 2-6. Validated Analytical Results for Slip 4 Cap Confirmation Samples

		Sample ID	SC-1	SC-1	SC-2	SC-3	SC-4	SC-5	SC-6	WC-1	WC-2	WC-3	WC-4	WC-5	WC-5 (field split)	WC-6	WC-7	WC-8	
		Lab ID	SD0034	SD0035	SD0036	SD0037	SD0038	SD0039	SD0040	SD0025	SD0026	SD0027	SD0028	SD0029	SD0030	SD0031	SD0032	SD0033	
		Sample Date	1/30/2012	1/30/2012	1/30/2012	1/30/2012	1/30/2012	1/30/2012	1/30/2012	1/30/2012	1/30/2012	1/30/2012	1/30/2012	1/30/2012	1/30/2012	2/1/2012	2/1/2012	2/1/2012	
Chemical Name	Method	Unit	SQS	CSL															
PCB Aroclors																			
Aroclor 1016	SW8082	µg/kg			3.7 U	4 U	3.8 U	19 U	20 U	3.8 U	19 U	3.8 U	3.9 U	3.8 U	3.7 U				
Aroclor 1221	SW8082	µg/kg			3.7 U	3.7 U	3.7 U	3.8 U	3.7 U	4 U	3.8 U	19 U	20 U	3.8 U	19 U	3.8 U	3.9 U	3.8 U	3.7 U
Aroclor 1232	SW8082	µg/kg			3.7 U	3.7 U	3.7 U	3.8 U	3.7 U	4 U	3.8 U	19 U	20 U	3.8 U	19 U	3.8 U	3.9 U	3.8 U	3.7 U
Aroclor 1242	SW8082	µg/kg			3.7 U	3.7 U	3.7 U	3.8 U	3.7 U	4 U	3.8 U	19 U	20 U	3.8 U	19 U	3.8 U	3.9 U	3.8 U	3.7 U
Aroclor 1248	SW8082	µg/kg			3.7 U	3.7 U	3.7 U	3.8 U	3.7 U	4 U	3.8 U	19 U	20 U	3.8 U	19 U	7.6 U	9.6 U	7.5 U	3.7 U
Aroclor 1254	SW8082	µg/kg			3.7 U	3.7 U	5.7	3.8 U	3.7 U	4 U	5.5	24	21	3.8	21	14	21	15	3.7 U
Aroclor 1260	SW8082	µg/kg			3.7 U	3.7 U	3.7 U	3.8 U	3.7 U	4 U	3.8 U	19 U	20 U	3.8 U	19 U	3.8 U	6.2	5.2	3.7 U
Total Aroclors	Calculated	µg/kg	130	1300 ^a	3.7 U	3.7 U	5.7	3.8 U	3.7 U	4 U	5.5	24	21	3.8	21	14	27.2	20.2	3.7 U
Total Aroclors OC	Calculated	mg/kg-oc	12	65	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Conventionals																			
Total organic carbon	Plumb1981	percent			0.186	0.112	0.336	0.147	0.461	0.059	0.082	0.242	0.421	0.27	0.111	0.122	0.246	0.474	0.341
Total solids	E160.3	percent			95.5	95.5	94	95	95.5	96.2	97	91.1	87.4	87.9	89.4	85.2	83.2	81.1	84.7
Metals																			
Arsenic	SW6010B	mg/kg	57	93	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	6 U	6 U	6 U	5 U
Cadmium	SW6010B	mg/kg	5.1	6.7	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.3	0.2 U	0.2 U	0.2 U
Chromium	SW6010B	mg/kg	260	270	16.2	17.2	22.3	18.1	16.5	13.5	17	16.1	18.1	15.5	18.8	14.7	32.1	16.8	16.1
Copper	SW6010B	mg/kg	390	390	17.8	16	16.8	15	14.8	15	18.3	15.4	16.6	17	17.3	17.8	20.1	17.4	16.9
Lead	SW6010B	mg/kg	450	530	2	2 U	3	2 U	2 U	2 U	2	3	3	3	2 U	3	4	3	2 U
Mercury	SW7471	mg/kg	0.41	0.59	0.02 U	0.03 U	0.02 U	0.02 U	0.05	0.02 U	0.02	0.02 U	0.02 U						
Silver	SW6010B	mg/kg	6.1	6.1	0.3 U	0.3 U	0.4 U	0.3 U	0.3 U										
Zinc	SW6010B	mg/kg	410	960	29	34	36	30	28	27	33	31	34	31	37	31	35	32	28
SVOCs																			
1,2,4-Trichlorobenzene	SW8270D	µg/kg	0.81 mg/kg-oc / 31 µg/kg	1.8 mg/kg-oc / 51	19 U	18 U	19 U	20 U	19 U	19 U	18 U	19 U	19 U	19 U	19 U				
1,2-Dichlorobenzene	SW8270D	µg/kg	2.3 mg/kg-oc / 35 µg/kg	2.3 mg/kg-oc / 50	19 U	18 U	19 U	20 U	19 U	19 U	18 U	19 U	19 U	19 U	19 U				
1,3-Dichlorobenzene	SW8270D	µg/kg	170	170	19 U	18 U	19 U	18 U	18 U	18 U	19 U	20 U	19 U	19 U	18 U	19 U	19 U	19 U	19 U
1,4-Dichlorobenzene	SW8270D	µg/kg	3.1 mg/kg-oc / 110	9 mg/kg-oc / 110	19 U	18 U	19 U	18 U	18 U	18 U	19 U	20 U	19 U	19 U	18 U	19 U	19 U	19 U	19 U
1-Methylnaphthalene	SW8270D	µg/kg	NA	NA	19 U	18 U	19 U	18 U	18 U	18 U	19 U	20 U	19 U	19 U	18 U	19 U	11 J	19 U	19 U
2,4-Dimethylphenol	SW8270D	µg/kg	29	29	19 UU	18 UU	19 UU	18 UU	18 UU	18 UU	19 UU	19 UU	19 UU	19 UU	18 UU	19 UU	19 UU	19 UU	19 UU
2-Methylnaphthalene	SW8270D	µg/kg	38 mg/kg-oc / 670 µg/kg	64 mg/kg-oc / 670 µg/kg	19 U	18 U	19 U	18 U	18 U	18 U	19 U	20 U	19 U	19 U	18 U	19 U	12 J	19 U	19 U
2-Methylphenol	SW8270D	µg/kg	63	63	19 U	18 U	19 U	18 U	18 UU	18 UU	18 U	19 U	19 U	19 U	19 U	18 U	19 U	19 U	19 U
4-Methylphenol	SW8270D	µg/kg	670	670	38 U	37 U	36 U	36 U	36 UU	37 U	38 U	39 U	37 U	38 U	36 U	37 U	37 U	38 U	38 U
Acenaphthene	SW8270D	µg/kg	16 mg/kg-oc / 500 µg/kg	57 mg/kg-oc / 500 µg/kg	19 U	18 U	19 U	18 U	18 U	18 U	19 U	20 U	19 U	19 U	24	17 J	46	19 U	19 U
Acenaphthylene	SW8270D	µg/kg	66 mg/kg-oc / 1300 µg/kg	66 mg/kg-oc / 1300 µg/kg	19 U	18 U	19 U	18 U	18 U	18 U	19 U	20 U	19 U	19 U	18 U	19 U	19 U	19 U	19 U
Anthracene	SW8270D	µg/kg	220 mg/kg-oc / 960 µg/kg	1200 mg/kg-oc / 960 µg/kg	19 U	18 U	19 U	18 U	18 U	18 U	19 U	20 U	19 U	22	14 J	40	11 J	19 U	19 U
Benzo(a)anthracene	SW8270D	µg/kg	110 mg/kg-oc / 1300 µg/kg	270 mg/kg-oc / 1600 µg/kg	19 U	18 U	20	18 U	18 U	18 U	18 U	28	20	19 U	25	19	52	28	19 U
Benzo(a)pyrene	SW8270D	µg/kg	99 mg/kg-oc / 1600 µg/kg	210 mg/kg-oc / 1600 µg/kg	19 U	18 U	11 J	18 U	10 J	18 U	18 U	20	12 J	19 U	11 J	9.9 J	21	14 J	19 U
Benzo(g,h,i)perylene	SW8270D	µg/kg</																	

Table 2-6. Validated Analytical Results for Slip 4 Cap Confirmation Samples

		Sample ID Lab ID Sample Date	SC-1 SD0034 1/30/2012	SC-1 SD0035 1/30/2012	SC-2 SD0036 1/30/2012	SC-3 SD0037 1/30/2012	SC-4 SD0038 1/30/2012	SC-5 SD0039 1/30/2012	SC-6 SD0040 1/30/2012	WC-1 SD0025 1/30/2012	WC-2 SD0026 1/30/2012	WC-3 SD0027 1/30/2012	WC-4 SD0028 1/30/2012	WC-5 SD0029 1/30/2012	WC-5 (field split) SD0030 1/30/2012	WC-6 SD0031 2/1/2012	WC-7 SD0032 2/1/2012	WC-8 SD0033 2/1/2012		
Chemical Name	Method	Unit	SQS	CSL																
Dibutyl phthalate	SW8270D	µg/kg	220 mg/kg-oc / 1400 µg/kg	1700 mg/kg-oc / 5100 µg/kg	19 U	18 U	19 U	18 U	18 U	18 U	19 U	20 U	19 U	19 U	18 U	19 U	19 U			
Diethyl phthalate	SW8270D	µg/kg	61 mg/kg-oc / 200 µg/kg	110 mg/kg-oc / 1200 µg/kg	47 U	46 U	47 U	45 U	46 U	44 U	46 U	47 U	49 U	47 U	48 U	45 U	48 U	47 U		
Dimethyl phthalate	SW8270D	µg/kg	53 mg/kg-oc / 71 µg/kg	53 mg/kg-oc / 160 µg/kg	19 U	18 U	19 U	18 U	18 U	18 U	18 U	19 U	20 U	19 U	19 U	18 U	19 U	19 U		
Fluoranthene	SW8270D	µg/kg	160 mg/kg-oc / 1700 µg/kg	1200 mg/kg-oc / 2500 µg/kg	11 J	19	53	18 U	35	18 U	18 U	19	67	89	20	140	100	270	120	31 J
Fluorene	SW8270D	µg/kg	23 mg/kg-oc / 540 µg/kg	79 mg/kg-oc / 540 µg/kg	19 U	18 U	19 U	18 U	18 U	18 U	18 U	19 U	20 U	19 U	33	22	65	10 J	19 U	19 U
HPAH	CALC	µg/kg	960 mg/kg-oc / 12000 µg/kg	5300 mg/kg-oc / 17000 µg/kg	20.4 J	53 J	179 J	18 U	137 J	18 U	18 U	52 J	263 J	233 J	29.3 J	318 J	239.9 J	632.6 J	307 J	50 J
Hexachlorobenzene	SW8270D	µg/kg	0.38 mg/kg-oc / 22 µg/kg	2.3 mg/kg-oc / 70	19 U	18 U	19 U	18 U	18 U	18 U	18 U	19 U	20 U	19 U	19 U	18 U	19 U	19 U	19 U	19 U
Hexachlorobutadiene	SW8270D	µg/kg	3.9 mg/kg-oc / 11 µg/kg	6.2 mg/kg-oc / 120 µg/kg	9.4 UJ	9.2 UJ	9.3 UJ	9 UJ	9.1 UJ	8.9 UJ	9.2 UJ	9.3 UJ	9.5 UJ	9.8 UJ	9.3 UJ	9.6 UJ	9 UJ	9.6 UJ	9.3 UJ	9.5 UJ
Hexachloroethane	SW8270D	µg/kg	NA	NA	19 U	18 U	19 U	18 U	18 U	18 U	18 U	19 U	20 U	19 U	19 U	18 U	19 U	19 U	19 U	19 U
Indeno(1,2,3-cd)pyrene	SW8270D	µg/kg	34 mg/kg-oc / 600 µg/kg	88 mg/kg-oc / 690 µg/kg	19 U	18 U	19 U	18 U	10 J	20 U	19 U	19 U	18 U	9.6 J	19 U	19 U				
LPAH	CALC	µg/kg	370 mg/kg-oc / 5200 µg/kg	780 mg/kg-oc / 5200 µg/kg	19 U	18 U	12 J	18 U	18 U	18 U	18 U	12 J	33	19 U	240 J	148 J	441	64 J	16 J	
N-Nitrosodiphenylamine	SW8270D	µg/kg	11 mg/kg-oc / 28	11 mg/kg-oc / 40	19 U	18 U	19 U	18 U	18 U	18 U	18 U	19 U	20 U	19 U	19 U	18 U	19 U	19 U	19 U	19 U
Naphthalene	SW8270D	µg/kg	99 mg/kg-oc / 2100 µg/kg	170 mg/kg-oc / 2100 µg/kg	19 U	18 U	19 U	18 U	18 U	18 U	18 U	19 U	20 U	19 U	11 J	18 U	19 U	19 U	19 U	19 U
Pentachlorophenol	SW8270D	µg/kg	360	690	190 U	180 U	190 U	180 U	180 U	180 UJ	180 U	190 U	200 U	190 U	190 U	180 U	190 U	190 U	190 U	190 U
Phenanthrene	SW8270D	µg/kg	100 mg/kg-oc / 1500 µg/kg	480 mg/kg-oc / 1500 µg/kg	19 U	18 U	12 J	18 U	18 U	18 U	18 U	12 J	33	19 U	150	95	290	43	16 J	
Phenol	SW8270D	µg/kg	420	1200	19 U	18 U	19 U	18 U	18 U	18 UJ	18 U	18 U	19 U	20 U	19 U	19 U	18 U	19 U	19 U	19 U
Pyrene	SW8270D	µg/kg	1000 mg/kg-oc / 2600 µg/kg	1400 mg/kg-oc / 3300 µg/kg	19 U	11 J	41	18 U	36	18 U	18 U	12 J	34	55	9.3 J	88	64	160	78	19 J

Notes:

^a The cleanup screening level is as reported in the Lower Duwamish Waterway feasibility study.

-- = No calculation performed because total organic carbon was outside of range.

J = The associated numerical value is the approximate concentration.

NA = Not available.

R = Rejected.

U = Not detected above the reported sample quantitation limit.

UJ = The analyte was not detected above the reported sample quantitation limit. However, the reported quantitation limit is approximate.

Results were OC-normalized for samples with TOC concentrations ranging from 0.5 to 4.0%. Results for samples that had TOC concentrations below or above this range were compared to SQS/CSL values.